

## SPECIAL FEATURES

This microcard contains the trouble-shooting instructions for the following models, valid at the time of compilation:

\* OPEL REKORD E (8.1984→)

ABS with 3 wheel-speed sensors and 3 hydraulic ducts.

Test with the ABS2 LED tester.

## STRUCTURE OF MICROFICHE

1. Read from left to right.

2. Title of microfiche (appears on each coordinate).

E16	Products/components/test step	
	Coordinate	

3. Limits of section

$\Rightarrow$	$\Leftarrow$	$\Leftarrow$	$\Rightarrow$ $\Leftarrow$
Beginning	Mid-section	End	One-page section

A01	—	$\Rightarrow$ $\Leftarrow$
-----	---	----------------------------

A02	—	$\Rightarrow$ $\Leftarrow$
-----	---	----------------------------

## TEST SPECIFICATIONS

For reasons of safety, the ABS must be tested only with the ABS tester. The rapid diagnosis chart contains all the important test specifications together with instructions for testing and trouble-shooting.

### TEST REQUIREMENTS FOR TESTING WITH ABS2 LED TESTER

- \* Regulatory tire size fitted?
- \* Check for firm seating and corrosion of ground of return-supply pump and of over-voltage protection relay term. 31.
- \* Check for leaks in hydraulic connections and sealing points at hydraulic modulator (visual examination).
- \* If the ABS warning lamp lights up intermittently when driving (e.g. after switching on consuming devices) and goes out again by itself, check the battery and power supply (generator, regulator and voltage drops).
- \* If the ABS warning lamp lights up constantly and does not go out, check the following points:
  - Controller plug sitting correctly on controller and latched?
  - All plug contacts O.K.?
  - Spring contacts latched?
  - V-belt snapped?  
(Generator provides no voltage, charge-indicator lamp and ABS warning lamp light up.

- \* For checking, switch on ignition to all program-selector-switch positions (tester operates with current supply from vehicle battery).
- \* Observe LED (green) for current supply in all program-selector-switch positions.
- \* Connect ABS2 LED tester to ABS wiring harness.

### C A U T I O N !

Disconnect and connect controller only with ignition switched off.

Do not run with tester connected!

Repeat the complete test program after each repair.

The Antiskid System is a vehicle safety system.

Work on this system demands detailed knowledge of the system.

The conventional brake system must be O.K.

### General information for trouble-shooting:

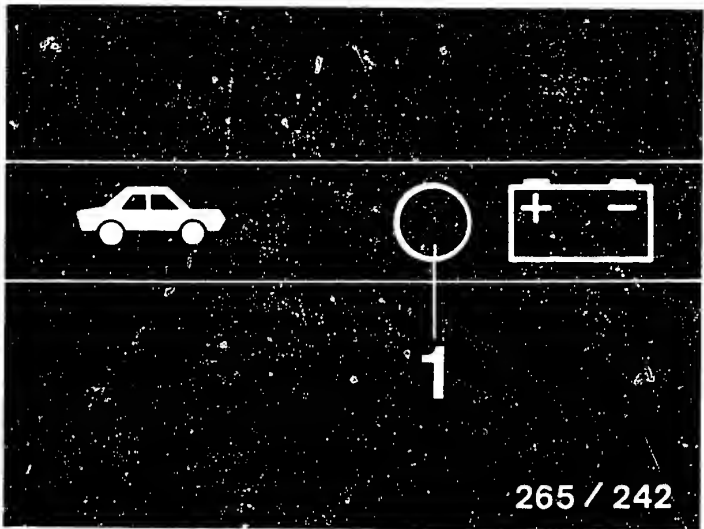
Check all leads for short circuit to ground and contact with positive lines and watch out for rubbed and pinched locations.

RAPID-DIAGNOSIS CHART FOR ABS2 LED TESTER

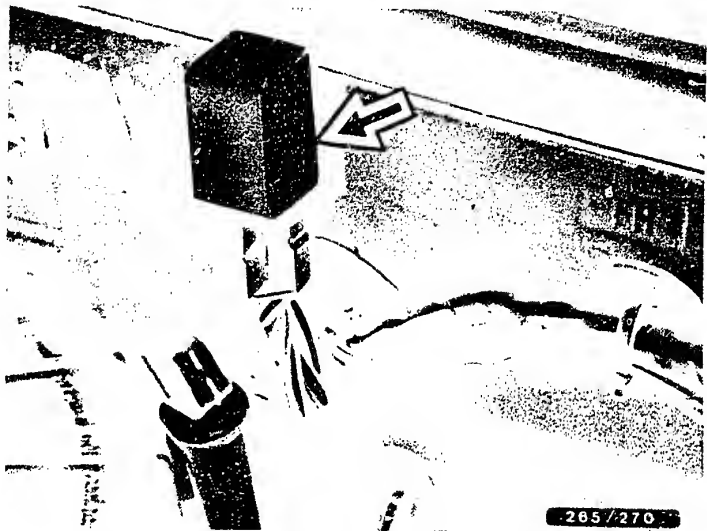
Do not drive vehicle with tester connected!

Program-switch position 1 to 6

Testing of (measurement at terminals)	Additional operation	Test specifi- cation (reading)	Possible causes of fault (see coordinate)
Voltage supply (term. 1 and term. 20)	Ignition on	LED 1 (top picture) lights up constantly	<ul style="list-style-type: none"><li>* 4-pin plug-in connection def. (C01)</li><li>* Battery inadequately charged (C03)</li><li>* Voltage drops too high (C03)</li><li>* Overvoltage-protection rel. def. (C03)</li><li>* Check lead to driving switch term. 15.</li></ul>



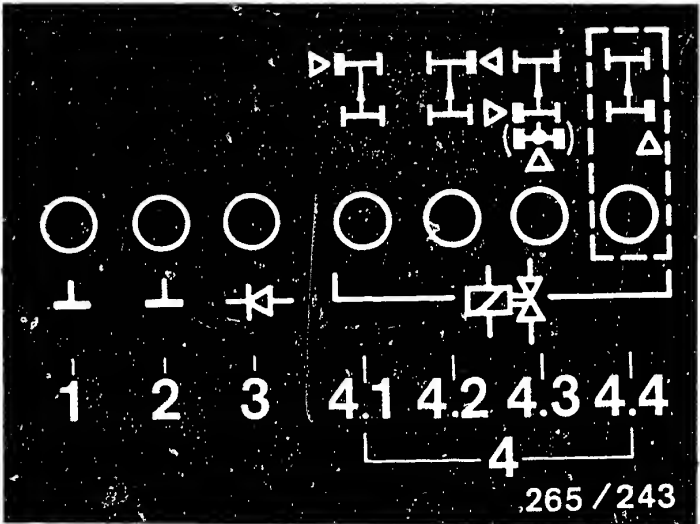
Arrow = Over-voltage  
protection relay



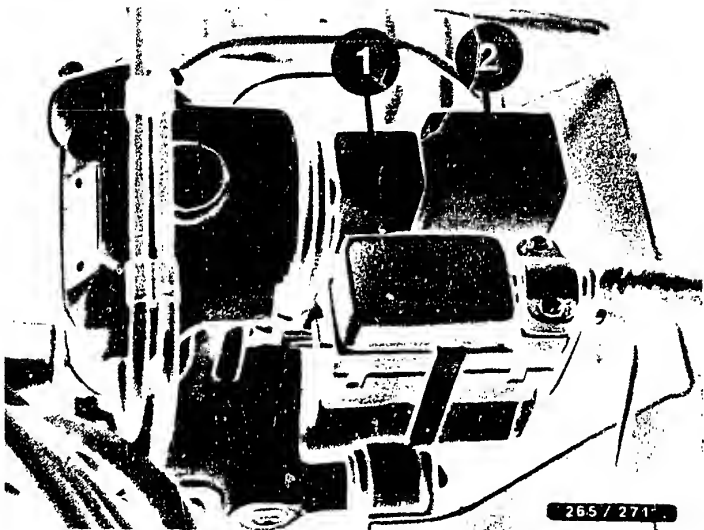
Rapid diagnosis chart (Continued 1)

Program-selector-switch position 1 (3-duct hydraulic modulator)

Test on (measurement at terminals)	Addit- ional operation	Test specification (reading)	Possible causes of trouble (see coordinate)
Ground (term.10, term.34)  Diode for warning lamp (term.29, term.32)  Solenoid-operated valve internal resistances (term.2, term.18, term. , term.35) Off-position and ground of valve relay  ABS warning lamp	Ignition on	6 LEDs (1 to 4.3)  light up equal- ly brightly (upper ill.)  ABS warning lamp in vehicle must light up	<ul style="list-style-type: none"><li>* LED 1 and / or 2 (upper illustration) do not light up:  Check ground terminals for short circuit. (C05, C07)</li><li>* LED 3 (upper illustration) does not light up: diode defective, check ground of valve relay. (C07, C09)</li><li>* One or more LED 4 do not light up: Check corresponding plug connection for solenoid-operated valve and leads. (C09)</li></ul> <p>Solenoid-operated valve, internal resistance 0,7...1,7 <math>\Omega</math></p> <ul style="list-style-type: none"><li>* All LED 4 and LED 3 do not light up:  Check ground of valve relay, valve relay defective. (C09)</li><li>* Weak lighting of a LED means contact resistance in corresponding current path. (C09)</li><li>* ABS warning lamp does not light up: warning lamp defective. Note: all other 6 LEDs light up  (B03)</li></ul>



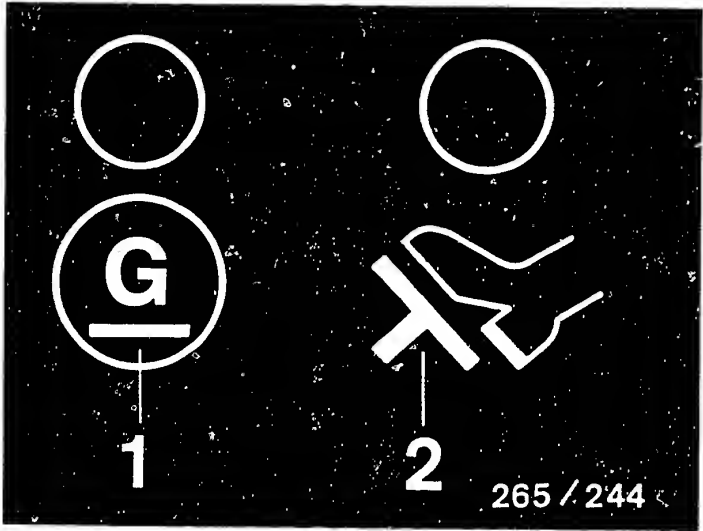
1 = Valve relay  
2 = Motor relay



RAPID DIAGNOSIS CHART (CONTINUATION 2)

Program-selector-switch position 2

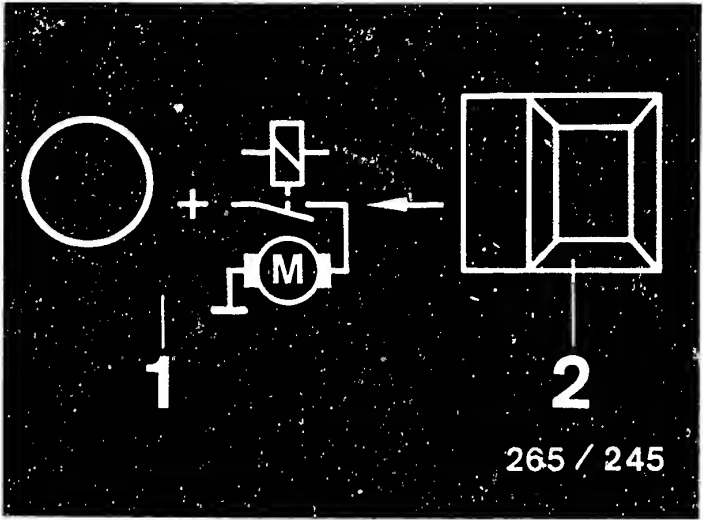
Test on (Measurement at terminals)	Addition- al operation	Test specification (reading)	Possible causes of trouble (see coordinate)
Generator voltage of term. 61 term. 15)	Ignition on	LED 1 (upper illustration) lights up.	* LED sometimes goes out only after snap acceleration (test is then O.K.) (C17)
	Start engine	LED 1 (upper illustration) goes out with engine running	* Check lead to generator term. 61  * Generator defective.
Stop-lamp switch (term. 25)	Ignition on	LED 2 (upper illustration) lights up	* Stop-lamp switch defective. (C19)  * Check lead to stop-lamp switch.
	Actuate brake pedal	LED 2 (upper illustration) goes out	* Lead at stop-lamp switch incorrectly connected.



Rapid diagnosis chart (Continued 3)

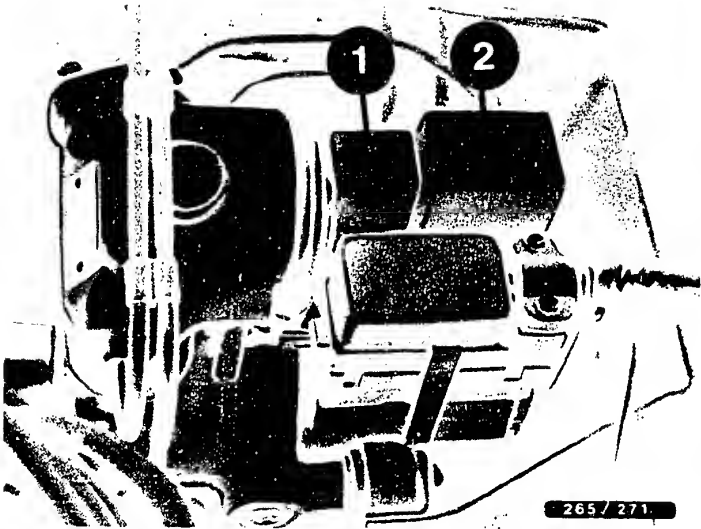
Program-selector-switch position 3

Test on (measurement at terminals)	Additional operation	Test specifications (reading)	Possible causes of trouble (see coordinate)
Motor relay, pump motor in hydraulic modulator (term.28 and term.14)	Ignition on, constantly press push- button 2 (upper ill- ustration)	LED 1 lights up, pump motor runs.  After releasing push-button, LED stays lit due to run-on of motor (upper illustration).	<ul style="list-style-type: none"><li>* Motor relay defective (C21)</li><li>* Check ground and positive terminal of hydraulic modulator (C23)</li><li>* Check leads from controller term.14 and term.28 to hydraulic modulator term.9 or term.11. (C23)</li><li>* Pump motor defective (C23)</li></ul>

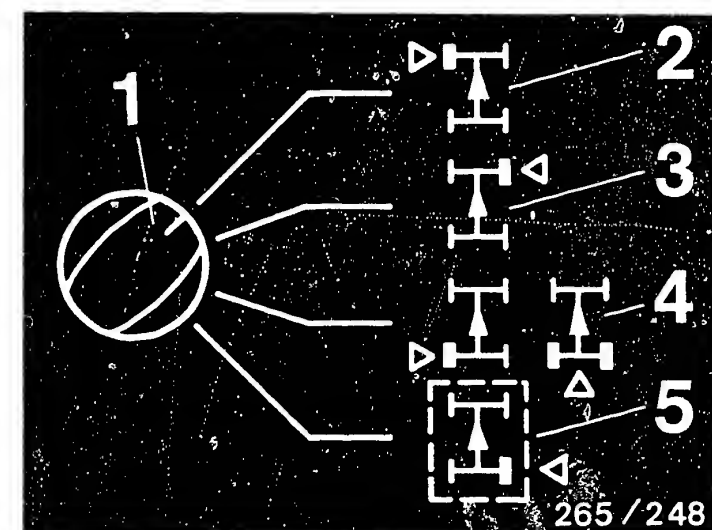


Program-selector-switch position 4 not applicable

1 = Valve relay  
2 = Motor relay



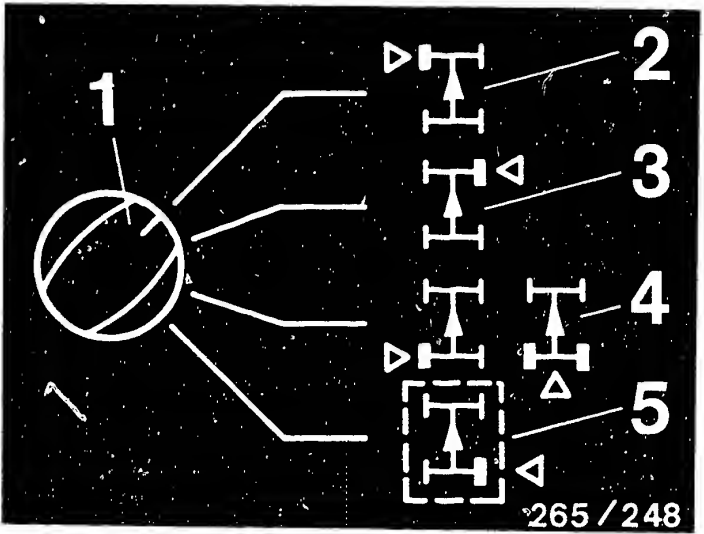
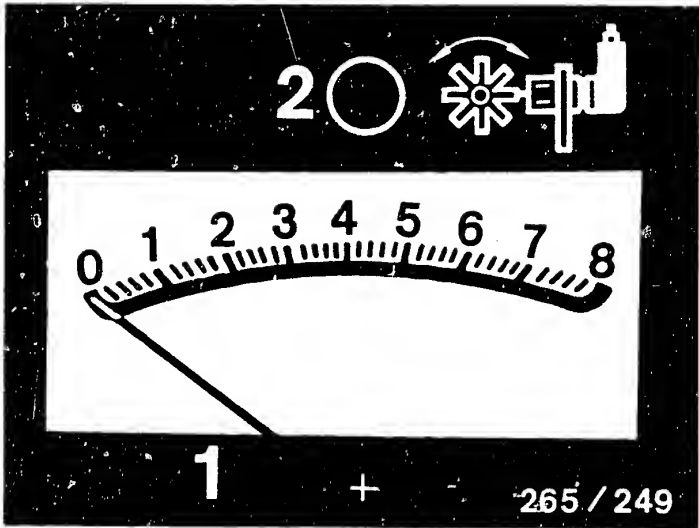
Program-selector-switch position 5 (4-channel hydraulic modulator)



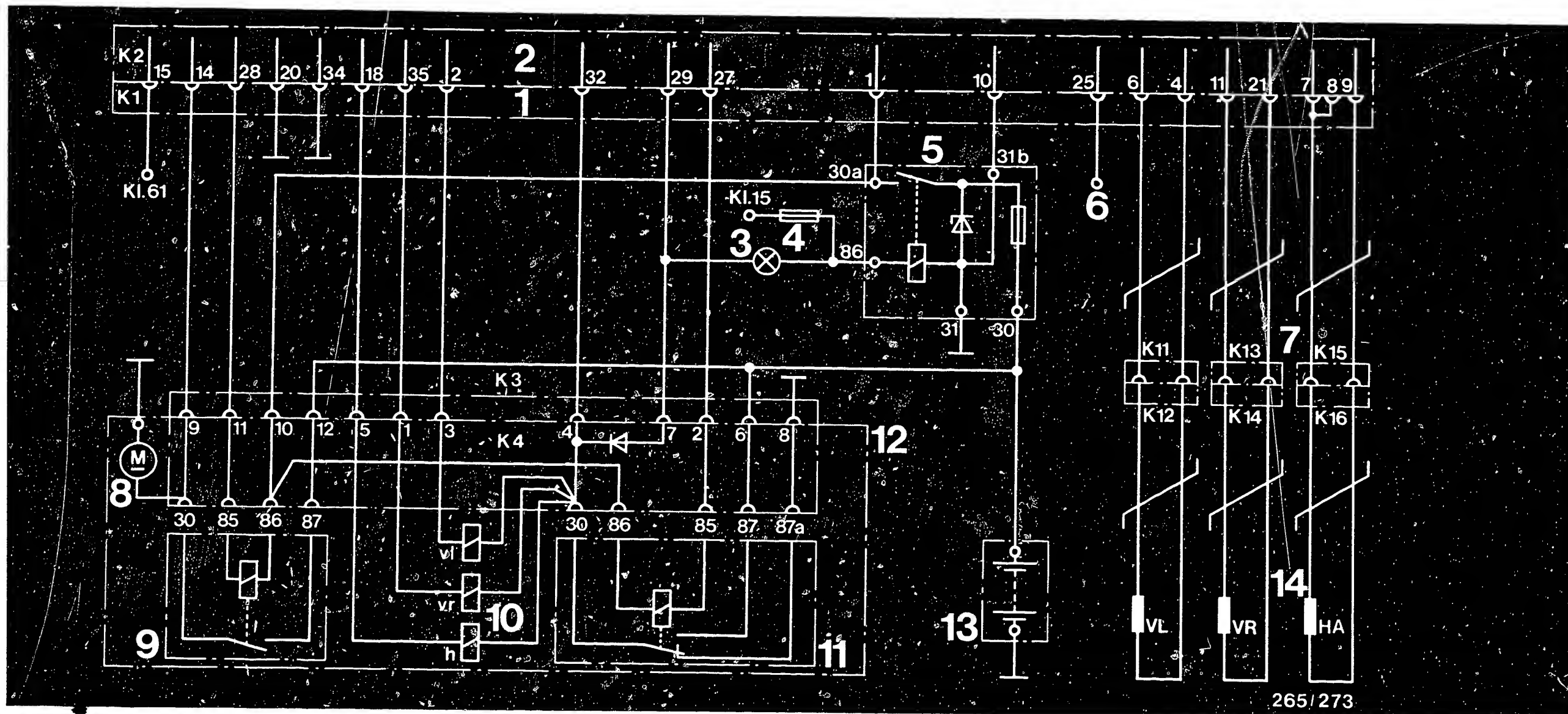
RAPID DIAGNOSIS CHART (CONTINUED 5)  
Program-switch position 6 (3 wheel-speed sensor)

Testing of (measurement at terminals)	Additional operation	Test specifi- cation (reading)	Possible causes of fault (see coordinates)
<p>Operation and interchanging of wheel-speed sensors</p> <p>NOTE: Conduct test consecutively for each wheel individually.</p> <p>(Wheel front left: Term.6 and term. 4 Wheel front right: Term.11 and term. 21 Rear axle: Term.7 and term.9</p>	<p>Jack up vehicle. Switch on ignition.</p> <p>It must be possible to turn the wheel under test freely by hand.</p> <p>When testing the driven axle, the wheel which is not under test must be held steady.</p> <p>Set switch for wheel selection to the wheel under test (bottom picture)</p> <p>Turn wheel by hand until LED 2 above instrument lights up without flickering. (Wheel speed approx. 1 revolution per second). Afterwards, read off indication at instrument: (Top picture)</p>	<p>1.Smallest reading larger 1,6 divisions</p> <p>2.Permissible fluc- tuation max. 25 % of largest reading.</p>	<p>* Wheel-speed-sensor lead mixed up (D17)</p> <p>* Break in wheel-speed- sensor lead (D17)</p> <p>* Wheel-speed sensor def. (D19)</p> <p>Winding resistance Front axle: 0,6...1,6 k <math>\Omega</math> Rear axle: 0,6...1,6 k <math>\Omega</math></p> <p>* Air gap between wheel- speed sensor and ring gear too wide (D19)</p> <p>* Ring gear defective or loose (D19)</p> <p>* Ring gear with incorr. number of teeth inst. Front axle: 48 teeth Rear axle: differing number of teeth on Cardan shaft depending on gear ratio (D15)</p> <p>* Wheel-bearing clearance too large</p>

Take for road test for final check. With the engine running, the warning lamp must go out. Drive at at least 30 km/h. The warning lamp must not light up again!







265/273

# ELECTRICAL TERMINAL DIAGRAM

- 1 = Controller plug
- 2 = ABS controller
- 3 = ABS warning lamp
- 4 = Fuse no. 6 (20A)
- 5 = Overvoltage-protection relay
- 6 = to stop-lamp switch (+)
- 7 = Multiple butt connector
- 8 = Return pump
- 9 = Motor relay

- 10 = Solenoid valves
- 11 = Valve relay
- 12 = Hydraulic modulator
- 13 = Battery

- VL = vl = front left
- VR = vr = front right
- HA = h = rear axle
- K1 to K16 = ABS plug-in connections

## TEST EQUIPMENT AND TOOLS

Designation	Code	Part number
ABS2 LED tester	KDAS 0003	Procure. address: Robert Bosch GmbH KH/VKD 3 Postfach 41 09 60 7500 Karlsruhe 41
Adapter lead (included in scope of delivery of tester)	KDAS 0003/2	
Charging and bleeding device		e.g. ATE Part No. 3.9302-1000.4 1)
Bleeder fitting for connection of charging and bleeding device to fluid reservoir of brake master cylinder		ATE Part No. 3.9302.0702.2 1)
Bleeder hose		ATE Part No. 3.3590.2300.1 1)
Auxiliary hose		ATE Part No. 3.9302.0704.2 1)
Brake-pedal-actuating device		ATE Part No. 3.9312.0100.4 1)

1) = obtainable from: Alfred Teves GmbH,  
Guerickestr. 7  
D-6000 Frankfurt (Main)

## Test equipment and tools (continued)

Designation	Code	Part number
Pressure tester Tester for checking low- pressure and high- pressure at hydraulic brake systems		e.g., ATE Part No. 3.9305-0200.4 1)
Flat double-end flare nut wrench, 9 x 11 mm		Hazet Part No. 612 2)
Container, approx. 1l for catching the brake fluid		
Brake fluid Use only DOT 4 or brake fluid from the vehicle manu- facturer.		
Electrics tester or multimeter for trouble- shooting	ETE 014.00	0 684 101 400  commercially available

Aids!

Use only original brake lines from the vehicle manu-  
facturer!

Grease for wheel-speed sensor	Molykote Longterm 2
Protective caps for brake lines	1 900 508 002 (100 pieces)
Protective caps for brake-line connections at hydraulic modulator	1 900 508 004 (100 pieces)

1) obtainable from: Alfred Teves GmbH Guerickestr. 7  
D-6000 Frankfurt (Main)

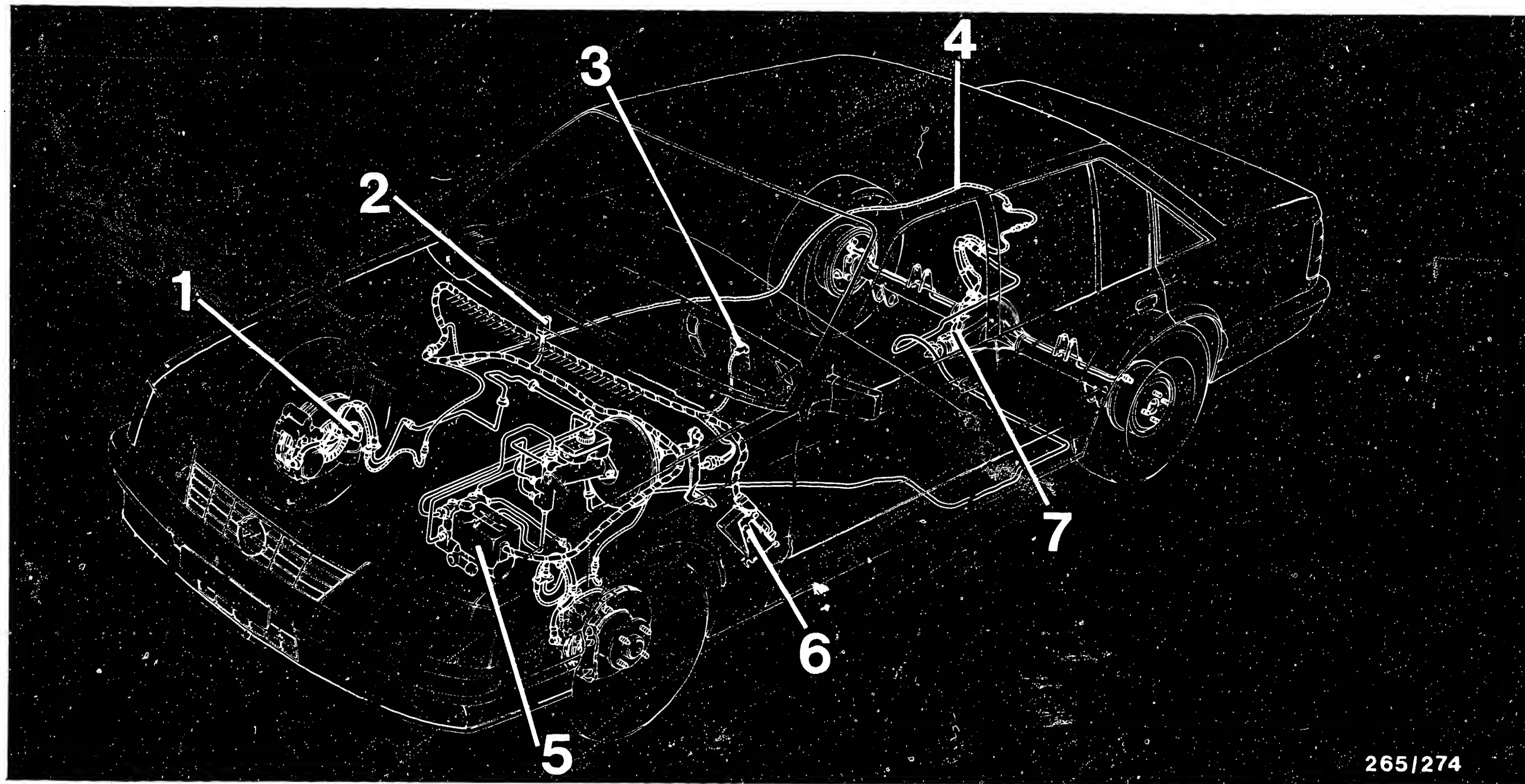
2) obtainable from: Hazet Co, D-5630 Remscheid

## INSTALLATION POSITION OF COMPONENTS

The stated installation positions always refer to the direction of travel.

- \* ABS warning lamp:  
In instrument panel.
- \* Wheel-speed sensor, front axle:  
One each on left and right in the steering knuckles.
- \* Wheel-speed sensor, rear axle:  
One wheel-speed sensor on the right on the rear-axle housing.
- \* Hydraulic modulator:  
In the engine compartment beneath the master brake cylinder (except 18 S engine).  
In vehicles with 18 S engine in the vicinity of the right-hand wheel arch in front of spring-strut dome.
- \* Controller:  
In driver's footwell behind the left-hand side panel.
- \* Overvoltage-protection relay:  
In the engine compartment on the firewall in the center of the vehicle.
- \* Controller:  
In the driver's footwell behind the left-hand side panel.
- \* Ground terminal:  
Common ground terminal for ABS and LE-Jetronic on intake manifold of 4th cylinder.

For production reasons:  
continued on the following  
coordinate.



265/274

# INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- |   |                                   |
|---|-----------------------------------|
| 1 = Wheel-speed sensor, front axle                                  | 5 = Hydraulic modulator           |
| 2 = Overvoltage-protection relay                                    | 6 = ABS controller                |
| 3 = ABS warning lamp  | 7 = Wheel-speed sensor, rear axle |
| 4 = ABS wiring harness<br>(integrated with Motronic wiring harness) |                                   |

## LEAKAGE TEST FOR THE BRAKE SYSTEM

After replacing the hydraulic modulator, bleed the brake system and carry out a high-pressure test.

### High-pressure test:

Line test pressure

Gauge pressure: approx. 70...90 bar

Test duration: approx. 10 minutes

Pressure drop of  
set value: 0 %

### Note:

The leakage test must be conducted for both brake circuits.

## GENERAL INFORMATION FOR REPAIRS AND ON BRAKE SYSTEM

The ABS is basically maintenance-free, however, when working on vehicles with ABS system the following must be noted:

1. When welding with electric welding equipment, pull plug from electronic controller.
2. When painting, the electronic controller may be loaded for a short time to max. + 95°C and for a long time (approx. 2 hours) to max. + 85°C.
3. After exchange of hydraulic modulator, controller, wheel-speed sensor and of the wiring harness, as well as after work in which the ABS units are touched (e.g. accident repairs), check the complete ABS system with the tester.  
Pay attention to correct assignment of brake lines and wheel-speed sensor connections at controller as well as wheel-speed-sensor plug connections (see vehicle-specific terminal diagram).
4. Each time after working on the brake system, the latter must be bled and go through low-pressure and high-pressure tests. Check all connections for leaks.
5. Tighten battery terminals to terminal posts of battery.
6. Do not use a fast charger for starting the engine.
7. Never disconnect the battery from the vehicle electrical system when the engine is running.

8. When fast charging, disconnect the battery from the vehicle electrical system.
9. Take care that all connectors of the wiring harness are seated perfectly.
10. Never disconnect or connect the ABS wiring-harness plug from the controller when the ignition is switched on.
11. For reasons of safety, the hydraulic modulator must never be repaired, but be exchanged only as a complete unit.

Excepted from this are the motor relay and the valve relay.

Both relays may be exchanged.

Apart from the brake-line connections, no screws at the hydraulic modulator may be loosened.

Once they are loosened, it is impossible to make the brake circuits leak-free ever again!

There is danger to life !

#### Caution when handling brake fluid!

- a) Fill brake fluid only into containers from which no one would mistakenly drink the fluid.  
(D a n g e r - p o i s o n o u s !)
- b) Even slight traces of mineral oil leads to failure of the brake system. Take particular care with respect to colorless through to yellow-dyed brake fluid, since the danger of a mix-up is in this case greatest. If mineral oil is found in the brake system or there is suspicion of this being the case, thoroughly flush out the complete brake system with brake fluid. In addition, replace the main cylinder.
- c) Do not allow brake fluid to come into contact with the vehicle paintwork, since the fluid contains elements which act as solvents for paint.
- d) Brake fluid is highly hygroscopic, i.e. it absorbs moisture from the air, which lowers its boiling point. For this reason, store brake fluid only in well-sealed storage containers.

#### Note:

During the course of the service life of brake fluid, its boiling point drops through continuous absorption of moisture from the atmosphere. In the case of very high loading of the brakes, vapor bubbles may therefore develop in the brake system.

Therefore, replace the brake fluid once a year, preferably in Spring.

## OPERATION AND TESTING OF THE ABS WARNING LAMP

A vehicle equipped with ABS comes into the workshop with one of the following customer complaints:

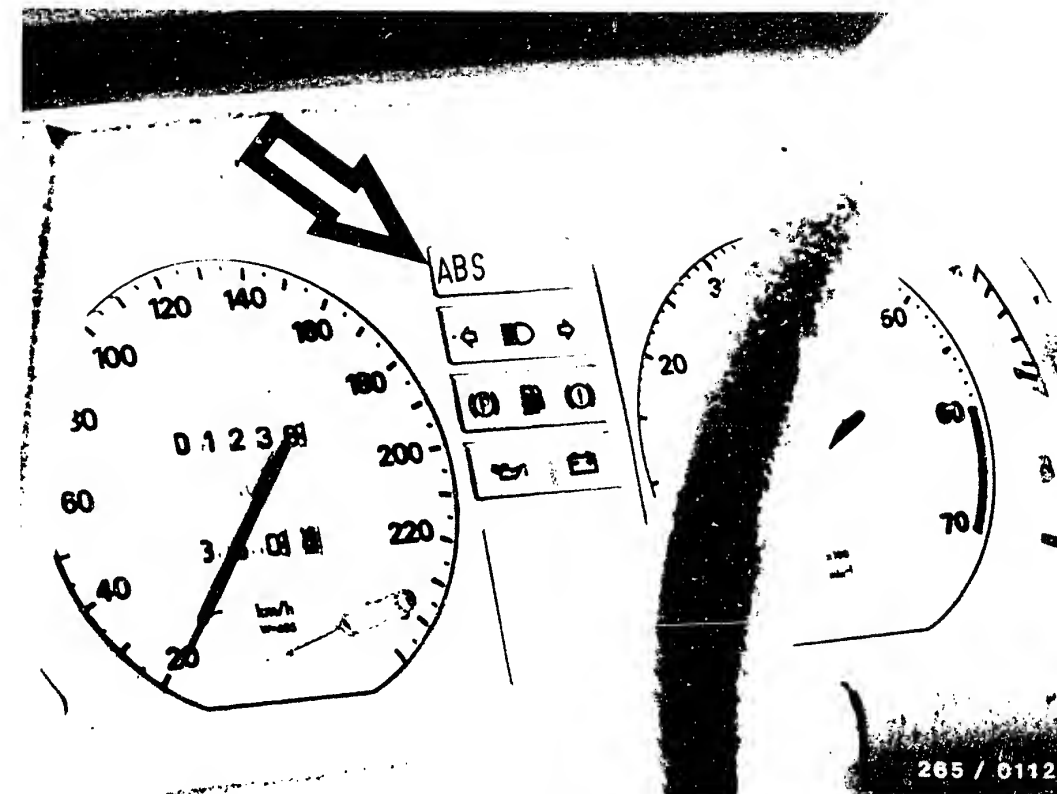
- \* Warning lamp does not light up after switching on ignition.
- \* Warning lamp does not go out after reaching idle speed.
- \* Warning lamp lights up again while driving or lights up occasionally.

Make sure of the circumstances before checking the complete ABS system with the ABS tester.

For reasons of safety, testing of the ABS is permitted only with the ABS tester.

When connecting the ABS tester, just as when disconnecting and connecting the controller, the ignition must always be switched off.

The following gives information about the functioning and malfunctioning of the ABS warning lamp.



ABS = ABS warning lamp in instrument panel

### ABS warning lamp

When the ignition is switched on, the warning lamp, marked with the letters "ABS", lights up.

When the engine starts and reaches idle speed the ABS warning lamp goes out (terminal 61 of generator supplies voltage to ABS controller). As soon as all 4 wheels of the vehicle exceed a speed of approx. 6 km/h for the first time after starting, the ABS system tests itself automatically (BITE sequence).

This procedure is repeated every time the ignition is switched off and the engine started up again. In addition, the ABS constantly tests itself to a certain extent while the vehicle is travelling.

### Incorrect warning-lamp indications are:

- \* Warning lamp does not light up after switching on ignition.
- \* Warning lamp does not go out after reaching idle speed.
- \* Warning lamp lights up when driving or lights up occasionally.

Lighting-up of the ABS warning lamp indicates to the driver that the ABS is defective.

Nevertheless, braking can still take place with the conventional brake system.

However, it is possible for the wheels to lock.

### General information:

Occasional lighting up of the warning lamp may be brought about through the battery being insufficiently charged.

The lamp lights up only as long as there is under-voltage, e.g. after switching on consuming devices when at idle.

The causes of trouble can be determined with the assistance of the ABS tester.

## OPERATION OF THE ABS2 LED TESTER

### 1. General

The BOSCH ABS2 LED TESTER checks the ABS components in a passenger car with hydraulic brake system.

The following BOSCH ABS systems can be checked:

- \* All ABS 2 versions (at present, ABS 2, ABS 2 B)
- \* ABS 2 B-function of the electronic traction control (ETC)

The tester checks the peripheral system components in 6 program steps:

- \* Hydraulic modulator
- \* Motor relay
- \* Valve relay
- \* Wheel-speed sensors
- \* Warning lamp
- \* Acceleration sensor
- \* Wiring harness
- \* Plug connections
- \* Ground cables
- \* Stop-lamp switch signal
- \* Generator signal

The ABS controller is not tested.

Self-diagnosis within the ABS controller makes additional testing of the controller with the tester unnecessary.

A brake test bench is not required for testing the ABS.

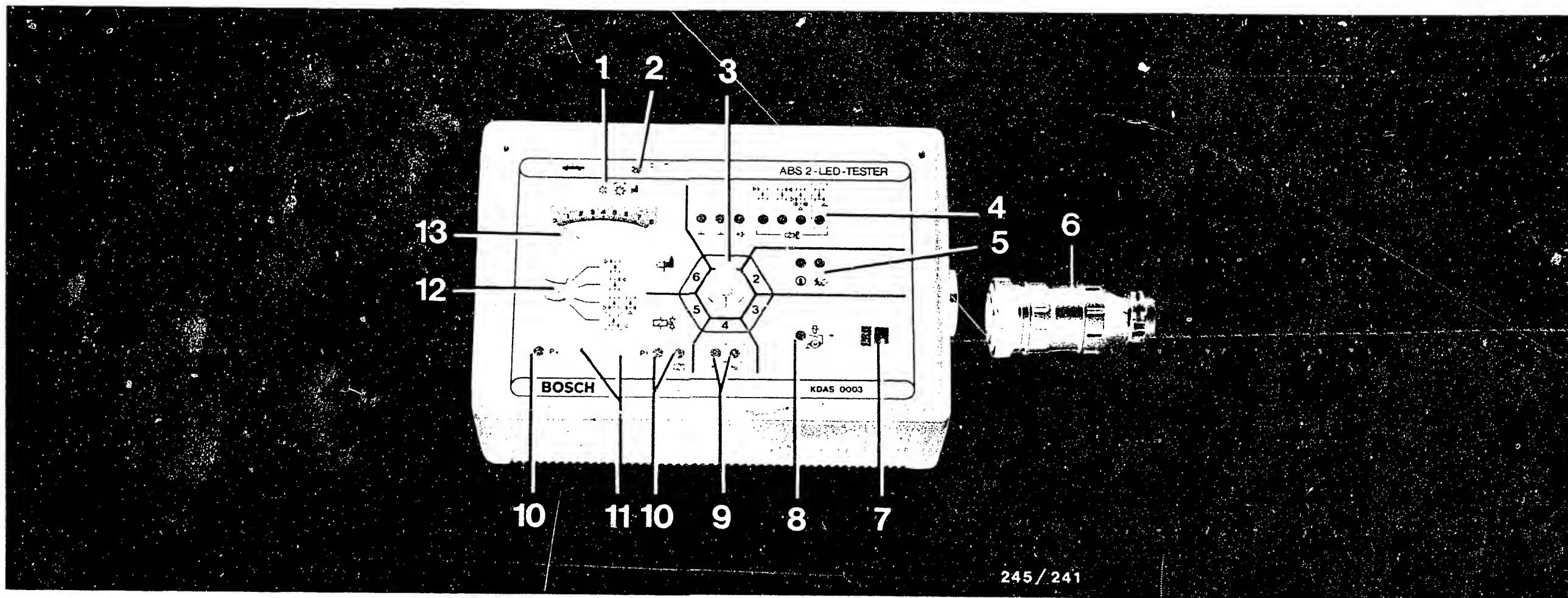
If a brake test bench is used, there is a danger of the vehicle jumping off the rollers!

Responsibility lies with the testing personnel if a brake test bench is used.

### 2. Structure of tester

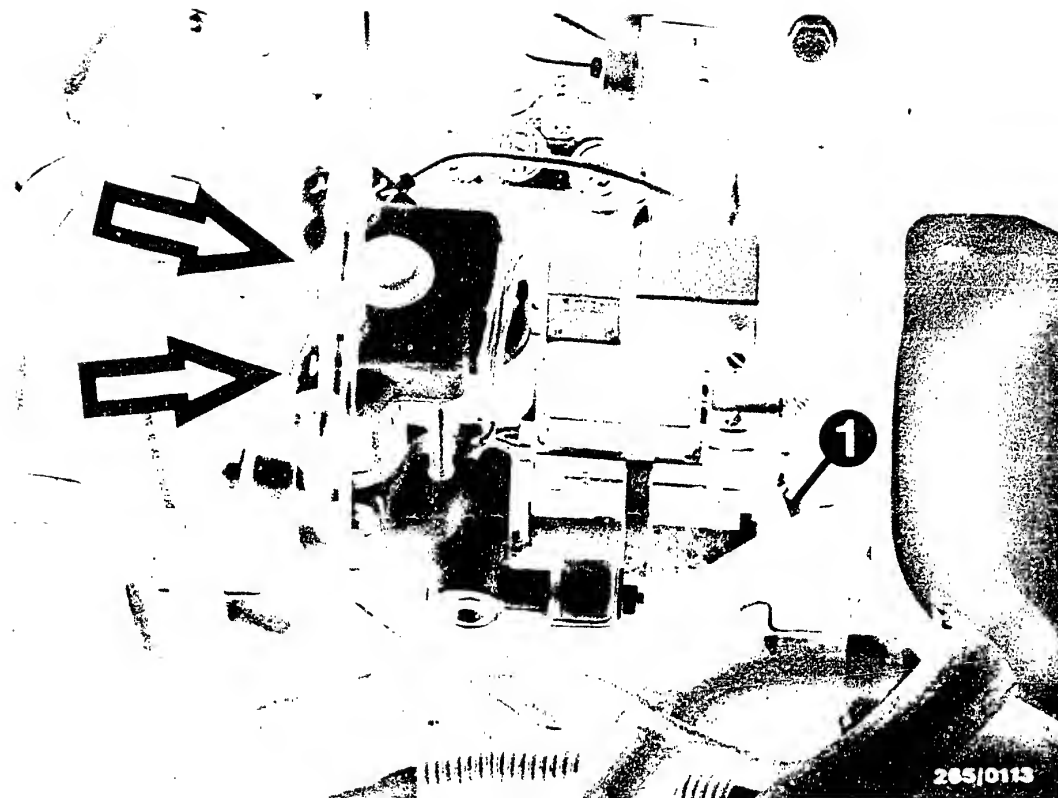
Failure is indicated by light-emitting diodes (LEDs), with the exception of wheel-speed sensor signals which are read off at the indicating instrument.





- 1 = 1 LED indicator for wheel speed in program-selector-switch position 6
- 2 = 1 LED indicator for battery voltage
- 3 = Program switch
- 4 = 7 LED indicators for program-selector-switch position 1
- 5 = 2 LED indicators for program-selector-switch position 2
- 6 = ABS adapter lead for connection to ABS wiring harness in vehicle
- 7 = Push-button for motor-relay control in program-selector-switch position 3
- 8 = 1 LED indicator for program-selector-switch position 3
- 9 = 2 LED indicators for program-selector-switch position 4
- 10 = 3 LED indicators for program-selector-switch position 5
- 11 = 2 push-buttons for tripping solenoid-operated valve functions.  
Pressure-holding and pressure-release in program-selector-switch position 5
- 12 = Rotary switch for selection of individual wheels.  
Functional in program-selector-switch position 5 and 6
- 13 = Indicating instrument for program-selector-switch position 6

Structure of tester (Continued)



- 1 = Hydraulic modulator
- 2 = Valve relay
- 3 = Motor relay
- 4 = Fastening nuts

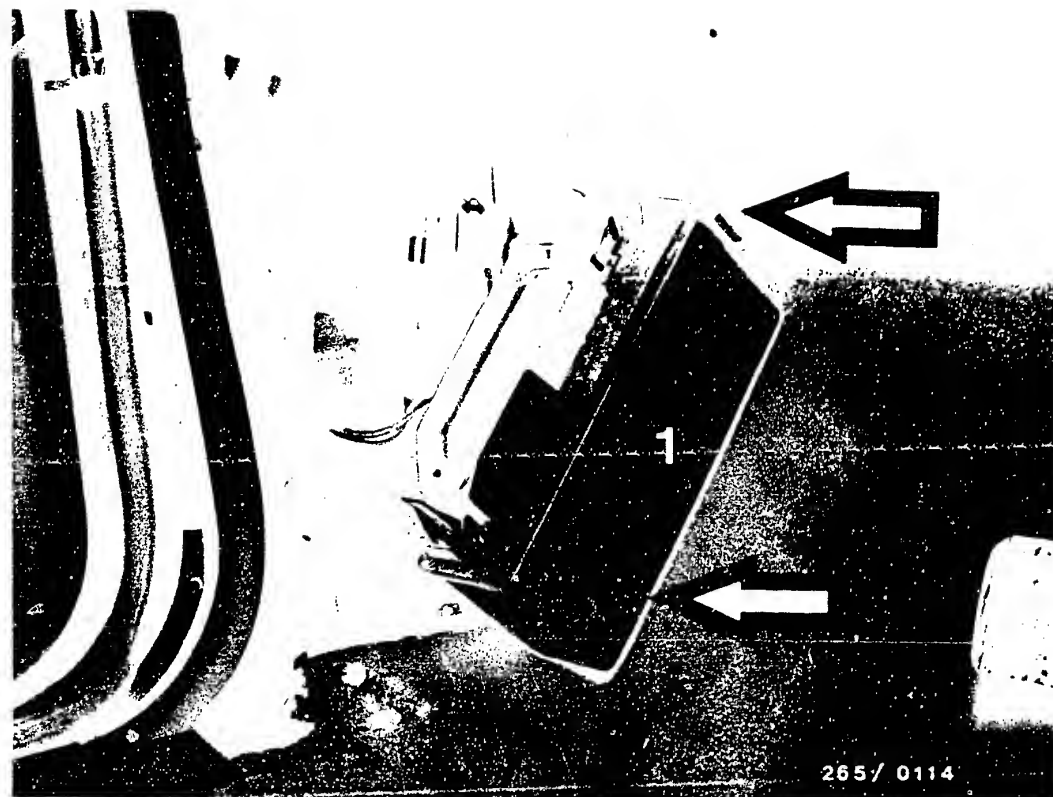
#### TEST REQUIREMENTS FOR TESTING USING ABS2 LED TESTER

- \* Regulatory tire size fitted?
- \* Check for firm seating of ground of return-supply pump.
- \* Check for firm seating of ground strap between engine block and vehicle frame.
- \* Check for leaks in hydraulic connections at hydraulic modulator and sealing points (arrows) (visual examination).

\* If the ABS warning lamp lights up intermittently when driving (e.g. after switching on consuming devices) and goes out again by itself, check the battery and power supply (generator, regulator and voltage drops).

\* If the ABS warning lamp lights up constantly and does not go out, check the following points:

- > Controller plug sitting correctly on controller and latched?  
All plug contacts O.K.?  
Spring contacts latched?
- > V-belt snapped? (Generator provides no voltage, charge-indicator lamp and ABS warning lamp light up).



1 = Controller for ABS  
Arrows = Fastening screws

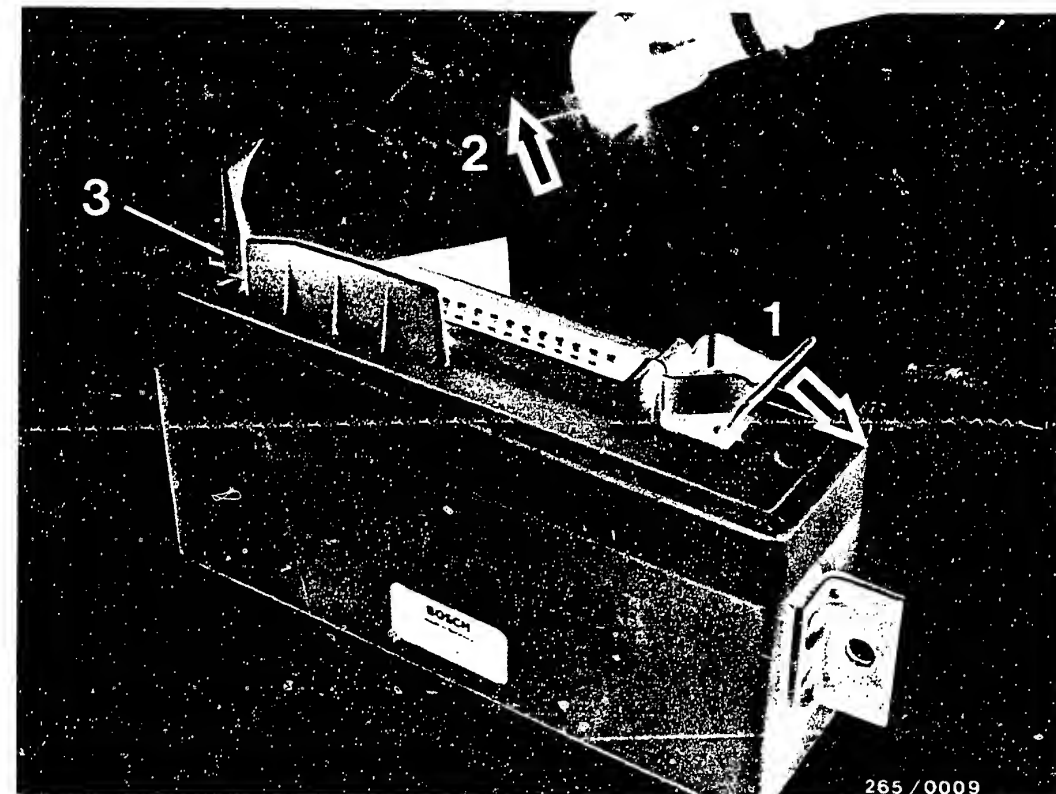
\* Connect LED tester to ABS wiring harness.

**Caution!**

Always detach and insert the controller with the ignition switched off.

The controller is fitted in the driver's footwell on the left-hand side.

To remove the controller, release the fastening screws and take out the controller.



1 = Spring  
2 = Controller plug (35-pin)  
3 = Coding unit

Switch off ignition before disconnecting controller plug.

Push back spring, pivot controller plug upwards and disconnect from coding unit.

- \* For checking with tester, switch on ignition in all program-selector-switch positions (tester operates with current supply from vehicle battery).
- \* One LED (green) indicates whether the voltage is sufficient.

Caution!

Do not run with tester connected!

After each repair, repeat the complete test program.

General note for trouble-shooting

Check all leads for short circuit to ground and contact with positive leads and watch out for rubbed and pinched locations.

For production reasons:  
continued on the following  
coordinate.

# TEST CHART FOR ABS 2 LED TESTER

TEST STEP 1

( TEST SPECIFICATIONS AND NOTES ON OPERATION )

## Component/Operation

Voltage supply (term. 20 and term. 1)

\* Operation: Position:  
Program switch all  
Push-button -

\* Operation in vehicle:  
Ignition on.

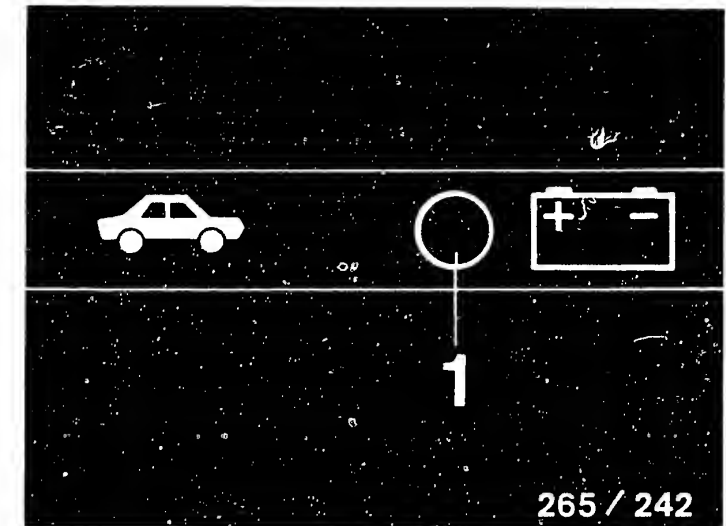
\* Test specification (indication)  
LED 1 (upper illustration) lights  
up continuously in all program-  
selector-switch positions.

## Trouble-shooting:

Switch off ignition!

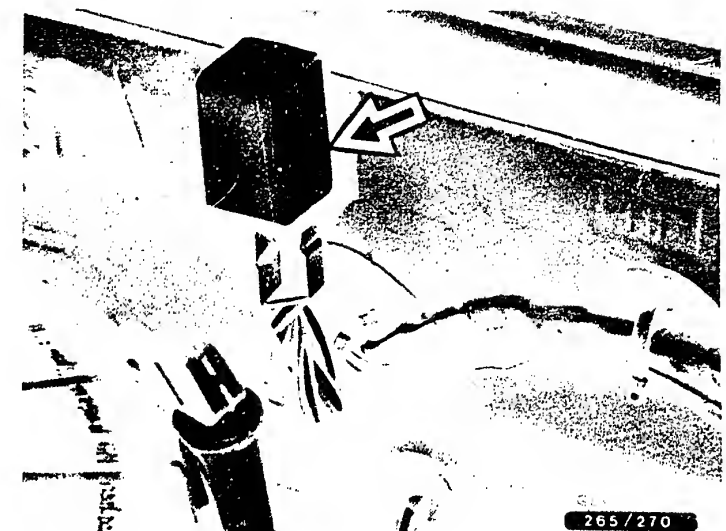
## No indication:

- \* Controller plug incorrectly connected
- \* Over-voltage protection relay defective: exchange.



1 = LED for supply voltage

Arrow = Over-voltage  
protection relay



Continued C05

Continued on next coordinate

C01

C02

Check the following leads:

- \* Positive lead from B+ to over-voltage protection relay term. 30
- \* Negative lead from over-voltage protection relay term. 31 to ground.
- \* Negative lead from over-voltage protection relay 31b to controller plug K1/term 10.
- \* ABS ground terminal must be bare metal and must have no contact resistance.
- \* Positive lead from over-voltage protection relay term. 30a to controller plug K1/term. 1.
- \* Positive lead from over-voltage protection relay term. 86 to driving switch term. 15.
- \* Check for firm seating of ground strap between engine block and vehicle frame.

LED 1 (green) occasionally lights up during the course of testing:

Discontinue testing and eliminate fault.

Causes of trouble:

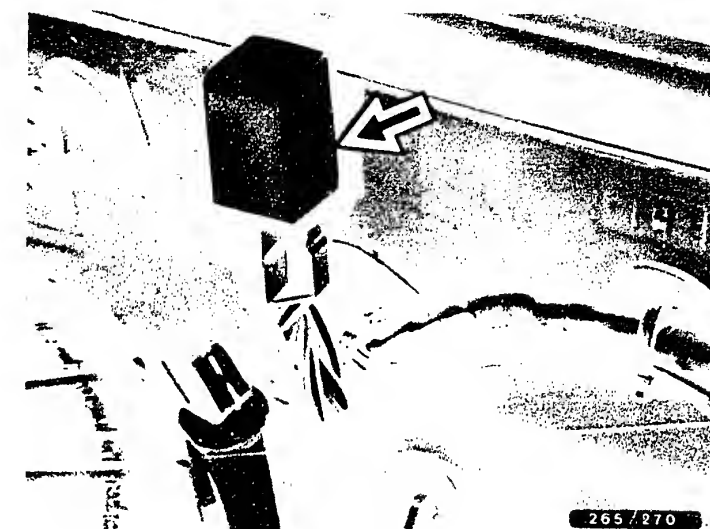
1. Battery insufficiently charged.  
Charge battery or leave engine running.
2. Voltage drops at ABS ground terminal too high, ground terminal must be bare metal.

After eliminating fault, continue with complete test program.



Arrow = Ground terminal for  
ABS and LE-Jetronic

Arrow = Over-voltage  
protection relay



## Component/Operation:

Ground (term. 34, term. 10)  
 Diode for warning lamp (term. 29,  
 term. 32)  
 Solenoid-valve internal resistances  
 term. 2, term. 35, term. 18.  
 Off-position and ground of valve  
 relay.  
 ABS warning lamp.

* Operation:	Position:
Program switch	1
Push-button	-

\* Operation in vehicle:  
 Ignition on.

\* Test specification (indication)  
 LED 1 up to LED 4.3 light up  
 equally brightly (see upper  
 illustration).

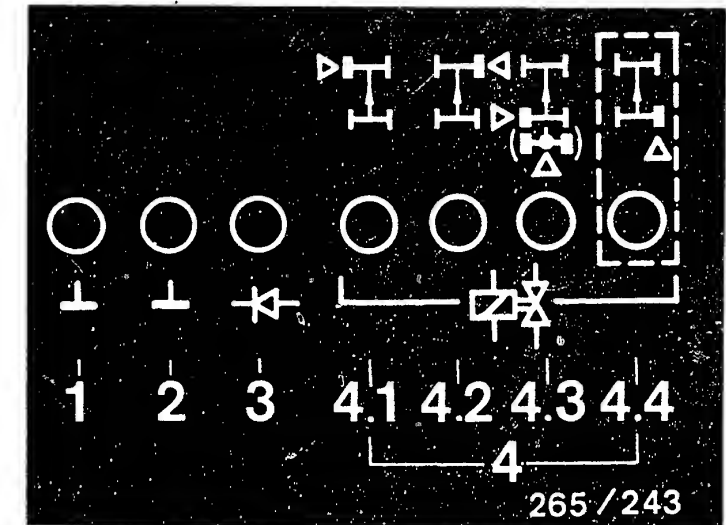
ABS warning lamp in vehicle must  
 light up.

## Trouble-shooting:

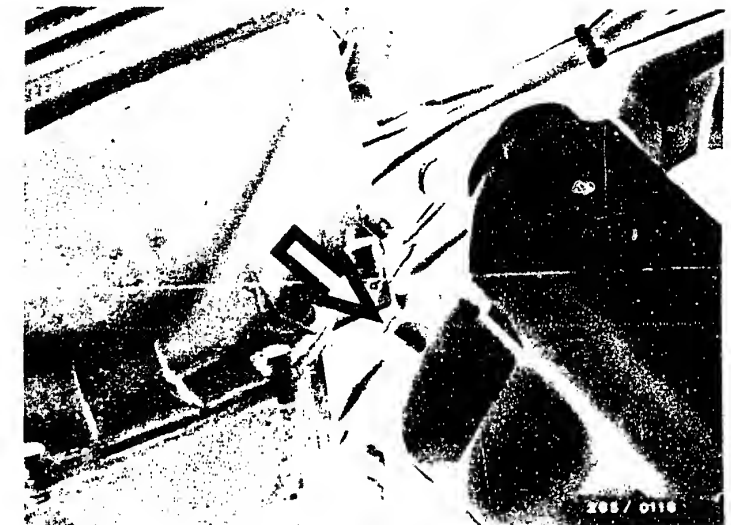
Switch off ignition!

1. LED 1 and/or 2 (upper  
 illustration) do(es) not light  
 up:

\* Check for firm seating of, too  
 high contact resistance at and  
 short circuit at ground terminal  
 at intake manifold (4 cyl.) as  
 well as ground strap between  
 engine block and vehicle frame.



Arrow = Ground terminal for  
 ABS and LE-Jetronic



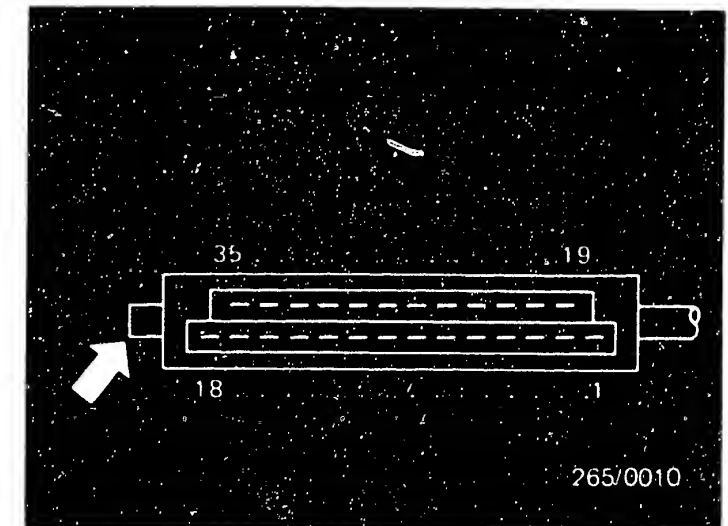
Continued C17

Continued on next coordinate

- \* Check for contact resistance and short circuit of ground lead from controller plug K1/term.10 via over-voltage protection relay term.31b to ground terminal.
- \* Check for contact resistance and short circuit of lead from ground to controller plug K1/term.34.
- \* Valve relay defective.  
Caution! Use only relay with correct electrical terminal assignment.

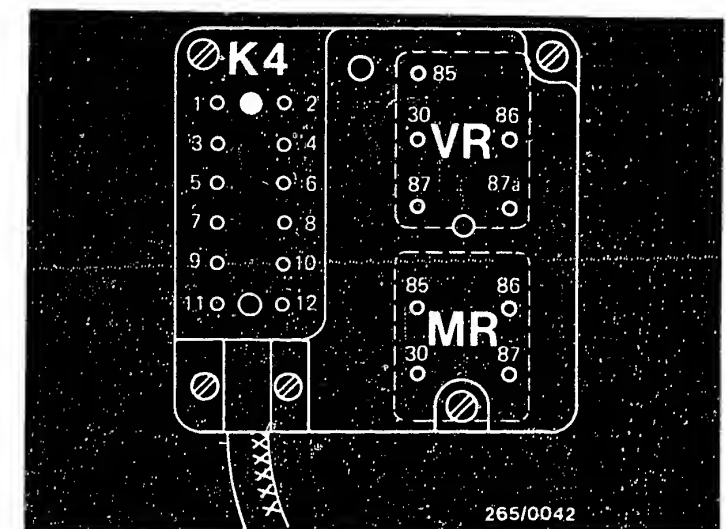
2. LED 3 does not light up:

- \* Check diode in forward direction and reverse direction with ohmmeter between K4/term.4 and K4/term.7.  
If diode defective, replace hydraulic modulator.
- \* Check for contact resistance and short circuit in ground of valve relay:  
From plug K3/term.8 to ground terminal.



Top view of controller plug K1 (35-pin) with terminal numbers.  
Arrow = Lug with mechanical encoding

Plug plate of hydraulic mod.,  
position of terminals:  
VR = Valve relay  
MR = Motor relay  
K4 = Wiring-harness plug





One or more LEDs 4 do not light up:

- \* Measure internal resistance directly at hydraulic modulator.

Test specifications:

Valve VL (LED 4.1) between K4/term.3 and K4/term.4: 0,7...1,7  $\Omega$

Valve VR (LED 4.2) between K4/term.1 and K4/term.4: 0,7...1,7  $\Omega$

Valve HA (LED 4.3) between K4/term.5 and K4/term.4: 0,7...1,7  $\Omega$

- \* If test specification is not obtained:

Replace hydraulic modulator.

- \* Check leads for continuity (test specification: 0  $\Omega$ ):

Valve VL (LED 4.1) between K3/term.3  
and controller plug K1/term.2

Valve VR (LED 4.2) between K3/term.1  
and controller plug K1/term.35

Valve HA (LED 4.3) between K3/term.5  
and controller plug K1/term.18

If test specification is not obtained:

Check plug-in connection for open circuit, corrosion and mechanical defect. Eliminate open circuit.

3. All LEDs 4 and LEDs 3 do not light up:

- \* Check ground connection of valve relay for contact resistance and open circuit:

From plug K3/term.8 to ground terminal.

- \* Valve relay defective.

4. LED lights up weakly:

- \* This signifies contact resistance in the relevant current path.

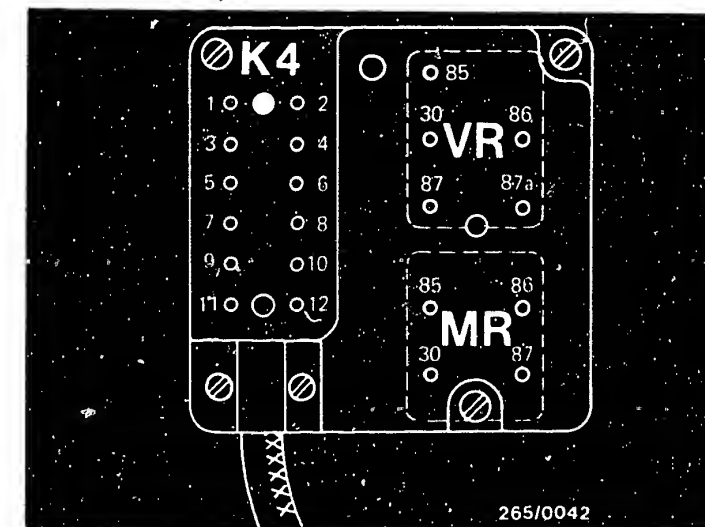
5. ABS warning lamp does not light up:

Warning lamp defective.

Check lead to driving switch term.15 and controller term.29.

Note:

All other 6 LEDs must light up.



Plug plate of hydraulic mod.,  
position of terminals:

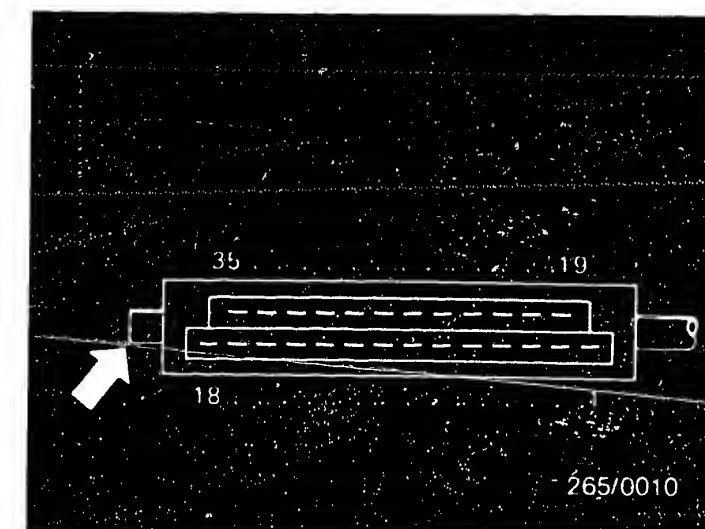
VR = Valve relay

MR = Motor relay

K4 = Wiring-harness plug

Top view of controller plug  
K1 (35-pin) with terminal  
numbers.

Arrow = Lug with mechanical  
encoding



Removing the hydraulic modulator

- \* For reasons of safety, the hydraulic modulator must not be repaired, but replaced only as a complete unit.

Excepted are the motor and valve relays.  
Both relays may be replaced.

- \* Excepting brake-line connections, no screws on the hydraulic modulator may be loosened.

In particular, the hexagon-socket-head cap screws or Torx screws must under no circumstances be loosened.

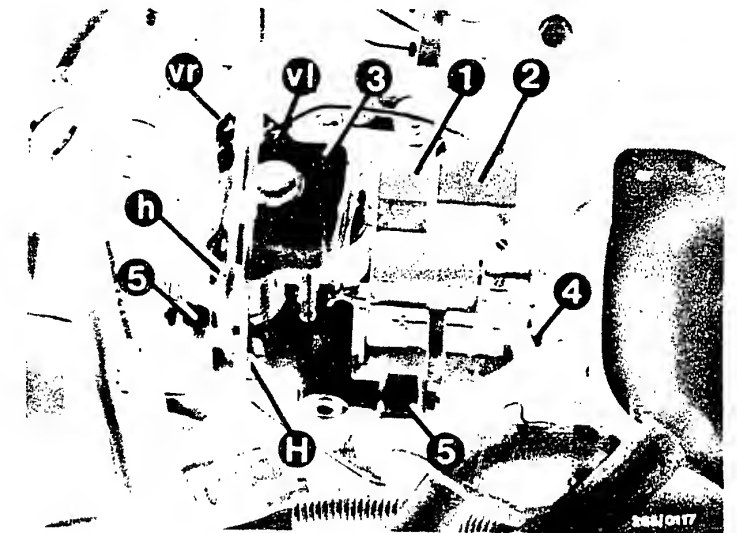
After loosening, the brake circuits can never be sealed again.

D a n g e r t o l i f e !

- \* Make visual examination for leaks in hydraulic modulator and brake-line connections.

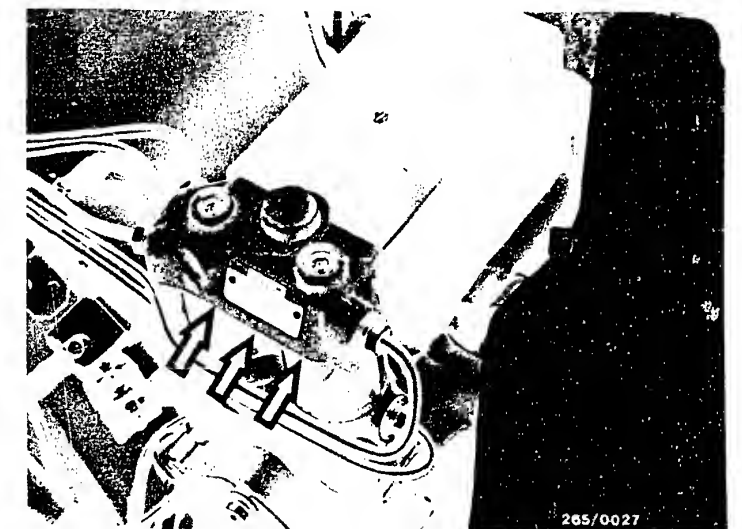
Pay particular attention to the sealing points indicated by arrows (upper illustration).

If brake fluid is escaping, tighten (12...16 Nm) or replace the brake-line connections, or replace the hydraulic modulator.



- 1 = Valve relay
- 2 = Motor relay
- 3 = Hydraulic modulator
- 4 = Ground term., pump motor
- 5 = Fastening screws

Arrows = Sealing points

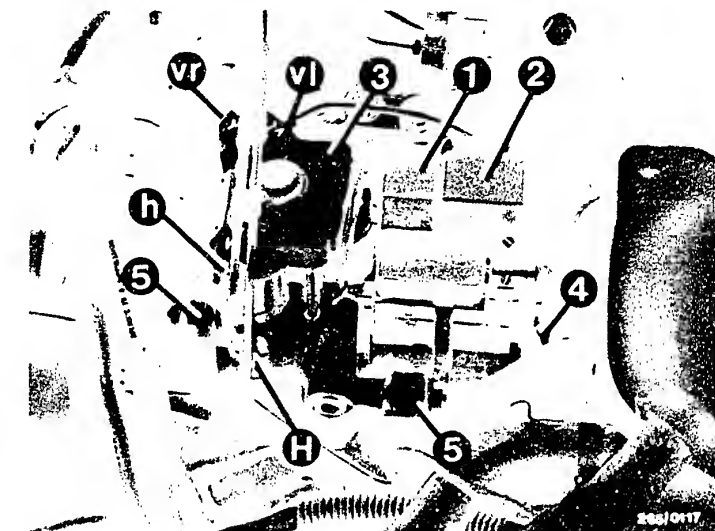


At the base of the hydraulic modulator there is a ventilation hole to the pump plunger.  
It is possible that small amounts of brake fluid escape at this point.  
A complaint is only justified if a pool of brake fluid forms beneath the hydraulic modulator when the brake pedal is pressed several times.

\* When removing and installing the brake lines ensure that the lines are marked in accordance with the marking on the hydraulic modulator and are reconnected in the correct order (e.g. "1" from the hydraulic modulator must be connected to the front-left wheel-brake cylinder).

\* Marking on hydraulic modulator:

- l = Connection for front-left brake line (wheel-brake cylinder)
- r = Connection for front-right brake line (wheel-brake cylinder)
- h = Connection for brake line for rear axle
- V = Front-axle brake circuit from master brake cylinder
- H = Rear-axle brake circuit from master brake cylinder

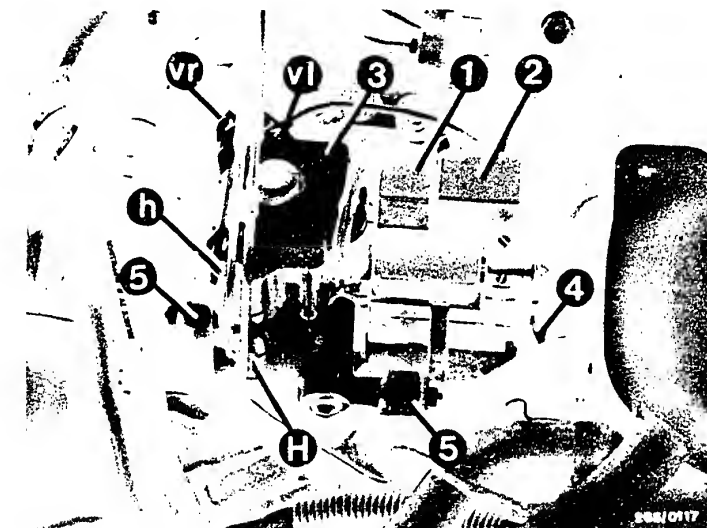


- 1 = Valve relay
- 2 = Motor relay
- 3 = Hydraulic modulator
- 4 = Ground term., pump motor
- 5 = Fastening screws

- \* Use only the specified double-head box wrench 9 x 11 mm for loosening and tightening the brake lines.
- \* Code brake lines and loosen from hydraulic modulator.
- \* Catch brake fluid and avoid contact with skin, clothing or paintwork!
- \* Seal brake lines and connections immediately with dummy plugs.
- \* Disconnect ground cable at pump motor.
- \* Loosen fastening screw and remove cap.
- \* Loosen hoop and remove plug.
- \* Loosen hexagon nuts of bracket and remove hydraulic modulator.

#### Installation

- \* Position hydraulic modulator into bracket and tighten with the hexagon nuts.
- \* Connect ground cable to pump motor. Connect 13-pin plug and fasten with the hoop.
- \* Tighten cap with screw on the hydraulic modulator.
- \* Connect brake lines to hydraulic modulator according to coding.
- \* Pay attention to tightening torque for brake-line connections at hydraulic modulator: 12...16 Nm.
- \* Bleed brake system and check for leaks.
- \* Thoroughly check ABS with tester.



- 1 = Valve relay
- 2 = Motor relay
- 3 = Hydraulic modulator
- 4 = Ground term., pump motor
- 5 = Fastening screws

Component/Operation:

Generator voltage of term. 61  
(term. 15)

\* Operation:  
Program switch  
Push-button

Position:

2
-

\* Operation in vehicle:  
Ignition on.

\* Test specification (indication):  
LED 1 (upper illustration) lights up.

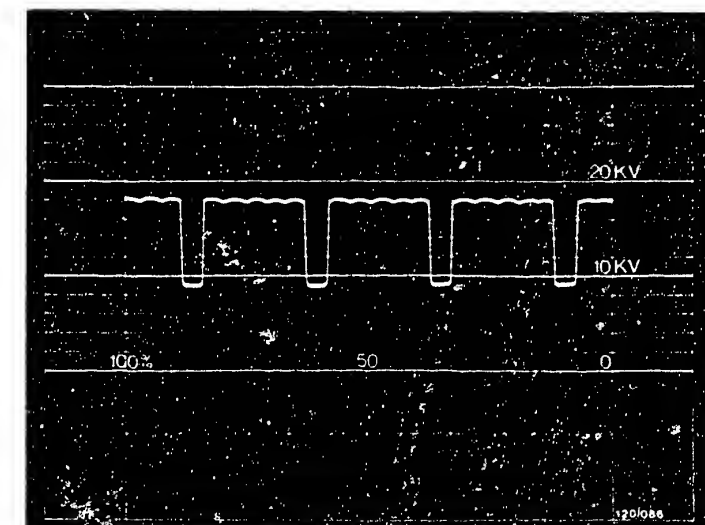
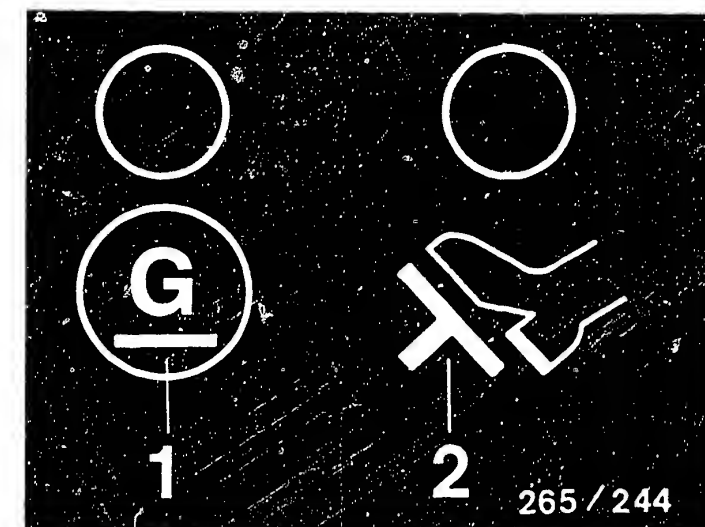
\* Operation in vehicle:  
Start engine.

\* Test specification (indication):  
LED 1 (upper illustration) goes out when engine running.

## Trouble-shooting:

LED 1 does not go out when engine running:

- \* Briefly accelerate.  
If LED 1 goes out, test is O.K.
- \* Voltage measurement at K1/  
term. 15 with engine running.  
Test specification: greater than 10 V.
- \* Oscilloscope measurement at K1/  
term. 15 with engine running.
- \* Voltage smaller than 10 V or  
pattern indicating defects.
- \* Repair generator and/or lead.



Continued on next coordinate

Continued on next coordinate

## Component/Operation:

Stop-lamp switch term. 25.

* Operation:	Position:
Program switch	2
Push-button	-

\* Operation in vehicle:  
Ignition on.

\* Test specification (indication):  
LED 2 (upper illustration) lights up.

\* Operation in vehicle:  
Actuate brake pedal.

\* Test specification (indication):  
LED 2 (upper illustration) goes out.

## Trouble-shooting:

1. LED 2 does not light up:

- \* Stop lamps defective.  
High contact resistance of stop lamps or their ground.  
Break in lead from controller term. 25 to stop-lamp switch.

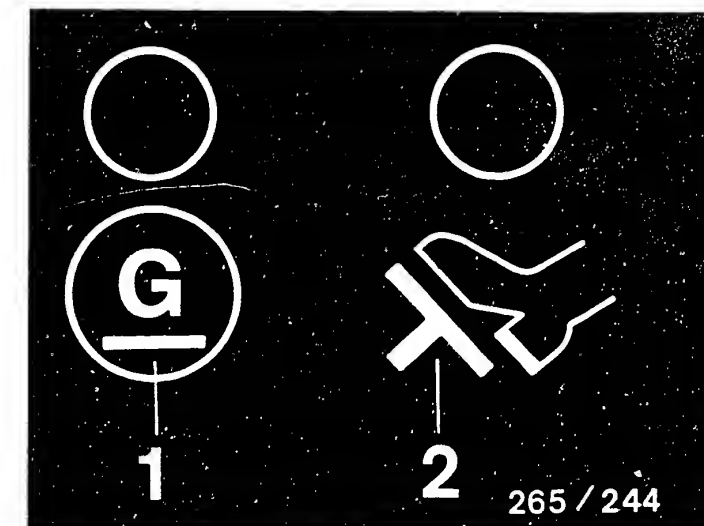
2. LED does not go out or only becomes somewhat dimmer:

- \* Fuse No. 7 for stop-lamp switch in fuse box defective.

- \* Voltage drop at stop-lamp switch (switch defective) or its plug connections.

- \* Stop-lamp switch defective.

- \* Lead to stop-lamp switch incorrectly connected.



Continued on next coordinate

Component/Operation:

Pump-motor motor relay in hydraulic modulator  
(term.28, term.14).

* Operation:	Position:
Program switch	3
Push-button (upper ill.)	2

\* Operation in vehicle:

Ignition on.  
Keep push-button 2 (upper ill.) pressed.

\* Test specification (indication):

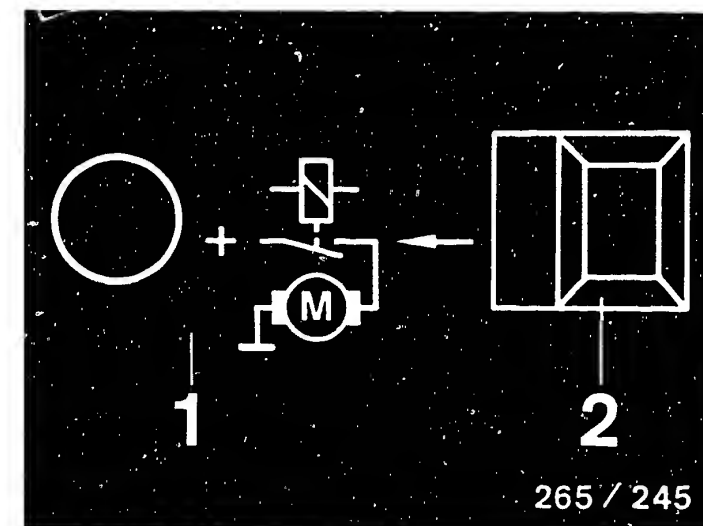
LED 1 lights up, pump motor runs.

After releasing the push-button,  
LED 1 stays lit due to run-on of  
motor (upper illustration).

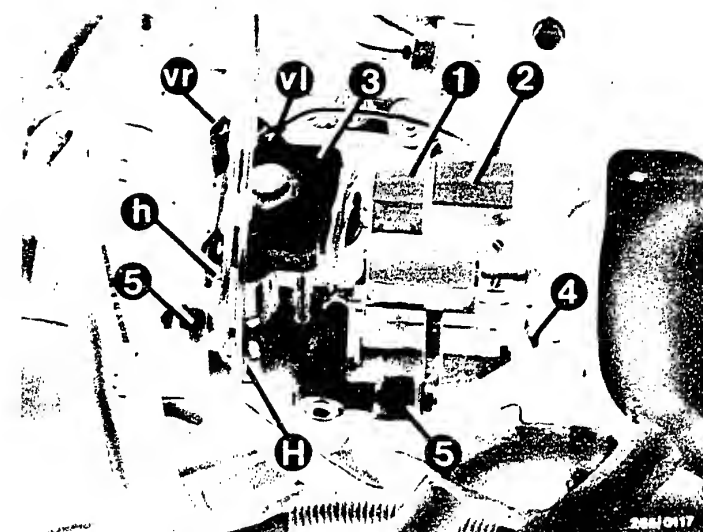
Trouble-shooting:Switch off ignition:

1. LED does not light up or pump  
motor does not start:

\* Motor relay defective (lower  
illustration).



1 = Valve relay  
2 = Motor relay



Continued D03

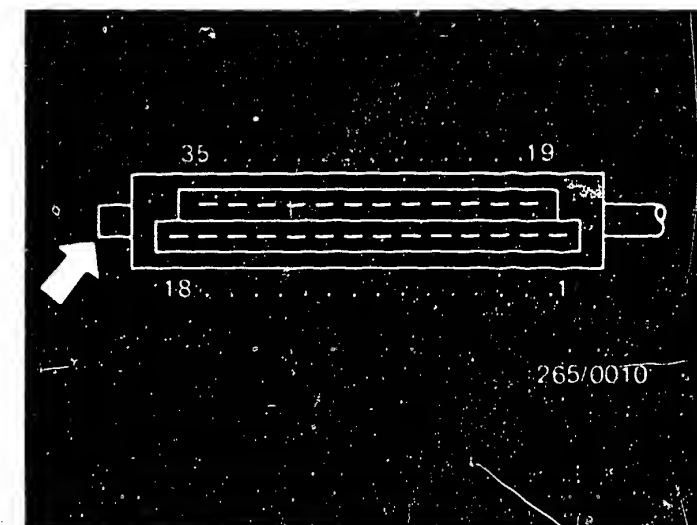
Continued on next coordinate

\* Check following leads for continuity:

- From controller plug K1/term.14 to plug K3/term.9.
- From K4/term.9 to motor relay term.30.
- From over-voltage protection relay term.30a to plug K3/term.10.
- From plug plate K4/term.10 to motor relay term.86.
- From motor relay term.85 to K4/term.11.
- From K3/term.11 to controller plug K1/term.28.
- From motor relay term.87 to K4/term.12.
- From K3/term.12 to term.B+.

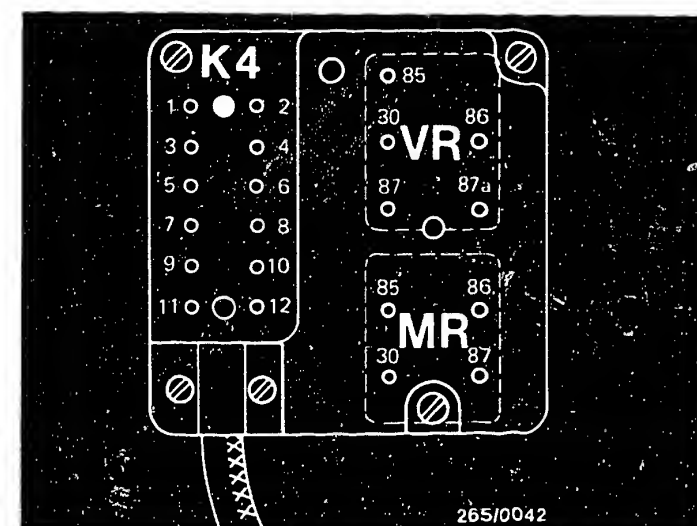
2. Pump motor does not run or LED does not stay lit or very briefly stays lit:

- \* Check for firm seating of and contact resistance in ground terminal of pump motor.
- \* Check for firm seating of positive connection of pump motor.  
Check lead from positive connection of pump motor to motor relay term.30.  
Check pump motor for continuity.
- \* Pump motor defective: exchange hydraulic modulator.



Top view of controller plug K1 (35-pin) with terminal numbers.  
Arrow = Lug with mechanical encoding

Plug plate of hydraulic mod.,  
position of terminals:  
VR = Valve relay  
MR = Motor relay  
K4 = Wiring-harness plug





# Removing the hydraulic modulator

- \* For reasons of safety, the hydraulic modulator must not be repaired, but replaced only as a complete unit.

Excepted are the motor and valve relays.  
Both relays may be replaced.

- \* Excepting brake-line connections, no screws on the hydraulic modulator may be loosened.

In particular, the hexagon-socket-head cap screws or Torx screws must under no circumstances be loosened.

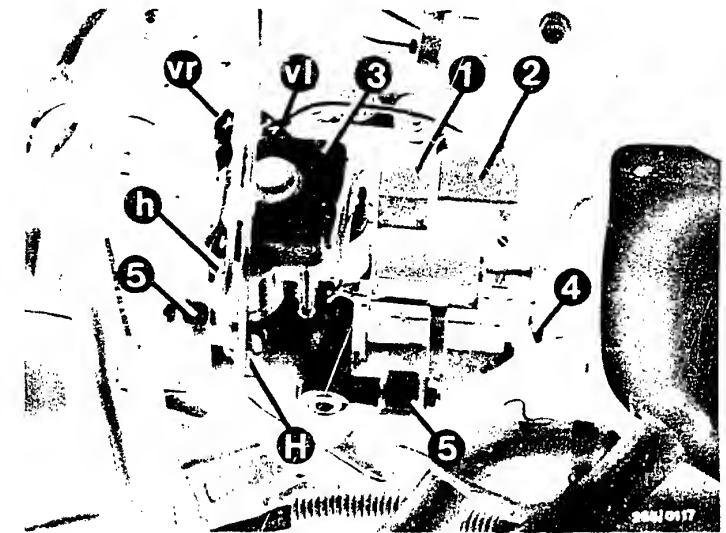
After loosening, the brake circuits can never be sealed again.

D a n g e r t o l i f e !

- \* Make visual examination for leaks in hydraulic modulator and brake-line connections.

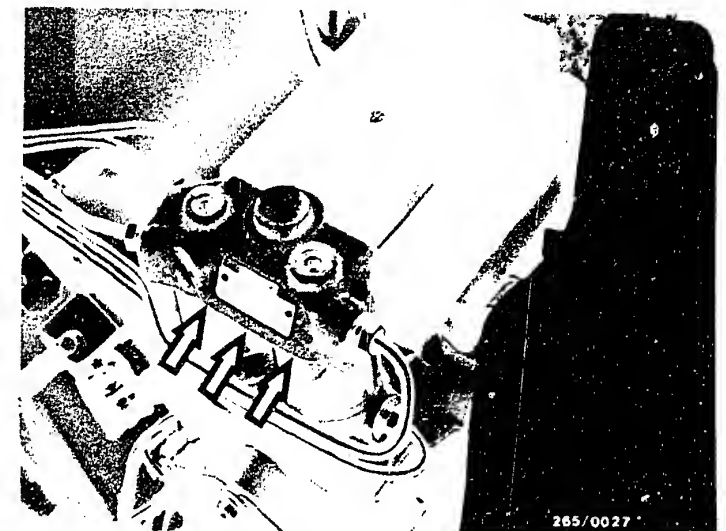
Pay particular attention to the sealing points indicated by arrows (upper illustration).

If brake fluid is escaping, tighten (12...16 Nm) or replace the brake-line connections, or replace the hydraulic modulator.



- 1 = Valve relay
- 2 = Motor relay
- 3 = Hydraulic modulator
- 4 = Ground term., pump motor
- 5 = Fastening screws

Arrows = Sealing points

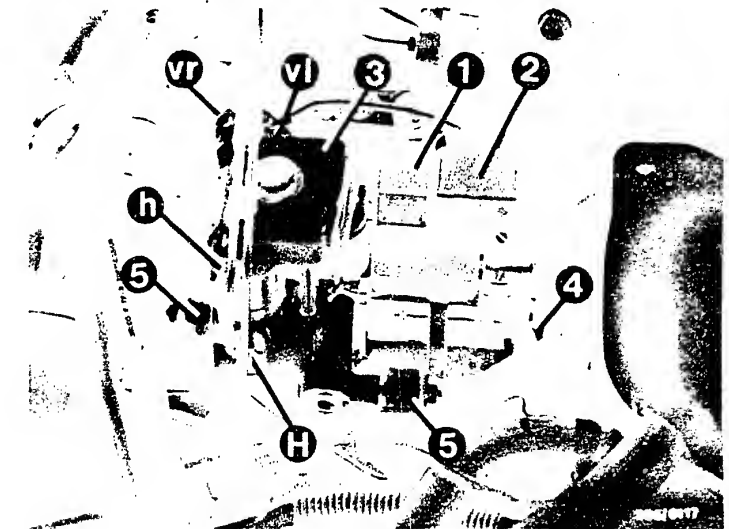


At the base of the hydraulic modulator there is a ventilation hole to the pump plunger. It is possible that small amounts of brake fluid escape at this point. A complaint is only justified if a pool of brake fluid forms beneath the hydraulic modulator when the brake pedal is pressed several times.

\* When removing and installing the brake lines ensure that the lines are marked in accordance with the marking on the hydraulic modulator and are reconnected in the correct order (e.g. "1" from the hydraulic modulator must be connected to the front-left wheel-brake cylinder).

\* Marking on hydraulic modulator:

- l = Connection for front-left brake line (wheel-brake cylinder)
- r = Connection for front-right brake line (wheel-brake cylinder)
- h = Connection for brake line for rear axle
- V = Front-axle brake circuit from master brake cylinder
- H = Rear-axle brake circuit from master brake cylinder

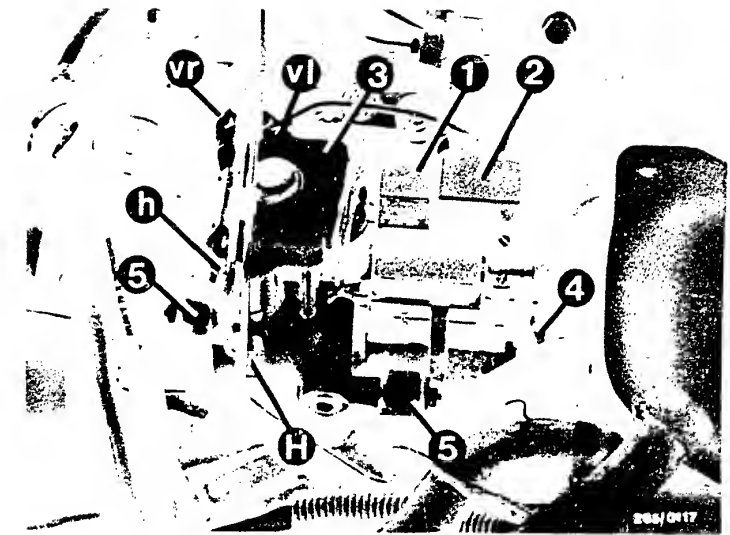


- 1 = Valve relay
- 2 = Motor relay
- 3 = Hydraulic modulator
- 4 = Ground term., pump motor
- 5 = Fastening screws

- \* Use only the specified double-head box wrench 9 x 11 mm for loosening and tightening the brake lines.
- \* Code brake lines and loosen from hydraulic modulator.
- \* Catch brake fluid and avoid contact with skin, clothing or paintwork!
- \* Seal brake lines and connections immediately with dummy plugs.
- \* Disconnect ground cable at pump motor.
- \* Loosen fastening screw and remove cap.
- \* Loosen hoop and remove plug.
- \* Loosen hexagon nuts of bracket and remove hydraulic modulator.

#### Installation

- \* Position hydraulic modulator into bracket and tighten with the hexagon nuts.
- \* Connect ground cable to pump motor. Connect 13-pin plug and fasten with the hoop.
- \* Tighten cap with screw on the hydraulic modulator.
- \* Connect brake lines to hydraulic modulator according to coding.
- \* Pay attention to tightening torque for brake-line connections at hydraulic modulator: 12...16 Nm.
- \* Bleed brake system and check for leaks.
- \* Thoroughly check ABS with tester.



- 1 = Valve relay
- 2 = Motor relay
- 3 = Hydraulic modulator
- 4 = Ground term., pump motor
- 5 = Fastening screws

## TEST STEP 5

( TEST SPECIFICATIONS AND NOTES ON OPERATION )

Test step for program-switch position 4 not applicable.

Component/Operation:

Valve-relay operation term. 27

* Operation:	Position:
Program switch	5
Push-button	-

\* Operation in vehicle:  
Ignition on.

\* Test specification (indication):  
LED 3 (upper illustration)  
lights up.

Trouble-shooting:

Switch off ignition.

No indication:

\* Check the following leads for short circuit and contact resistance:

From K1/term. 27 to K3/term. 2.

From K1/term. 32 to K3/term. 4.

From K4/term. 4 to valve relay term. 30.

From K4/term. 2 to valve relay term. 85.

From K4/term. 6 to valve relay 87.

From K3/term. 6 to B+.

From valve relay term. 86 to motor relay term. 86.

\* Valve relay defective: exchange.

Continued on next coordinate

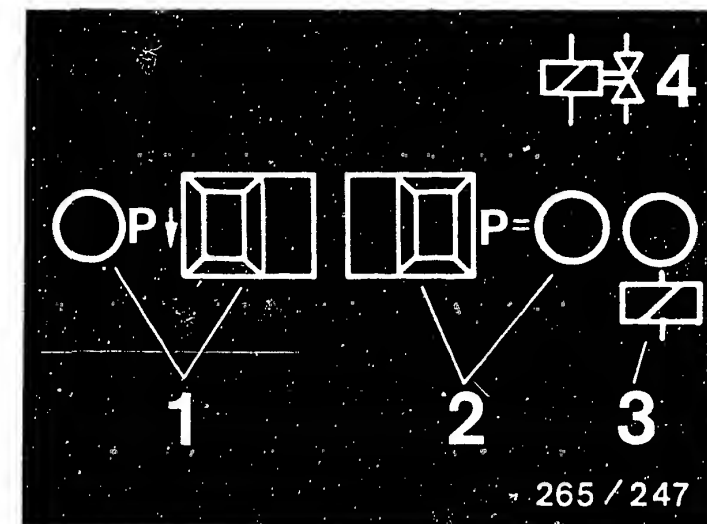
Continued on next coordinate

D03

&lt;=&gt;

D04

&lt;=&gt;

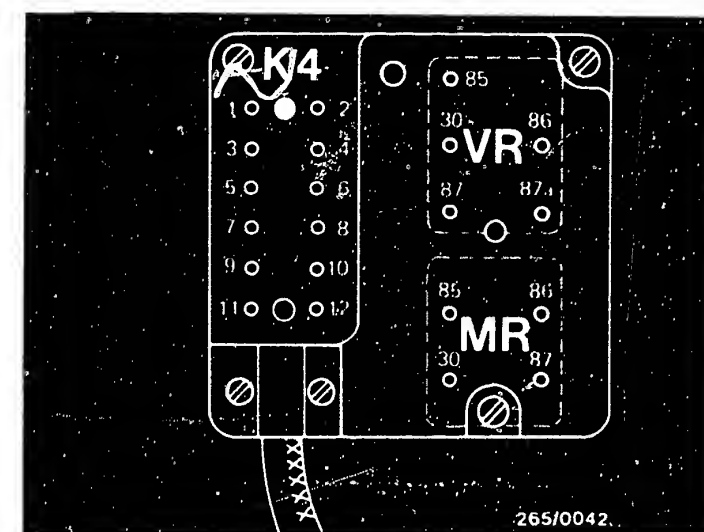


Plug plate of hydraulic mod.,  
position of terminals:

VR = Valve relay

MR = Motor relay

K4 = Wiring-harness plug



Component/Operation:

Check operation and for mix-up of solenoid-operated valves in hydraulic modulator.

Pressure-holding function point 1 to 3 and  
Pressure-release function point 4 to 5.

Note:

Check each wheel separately in turn, observe operating sequence.

\* Operation:                      Position:  
Program switch                      5

\* Operation in vehicle and at tester:

Chock up vehicle. The wheel being tested must be freely turnable by hand.

Ignition on.

Set switch 1 (upper ill.) for wheel selection to wheel to be tested.

1. (Lower illustration)

Push-button P = keep pressed

Test specification:

LED P = lights up.

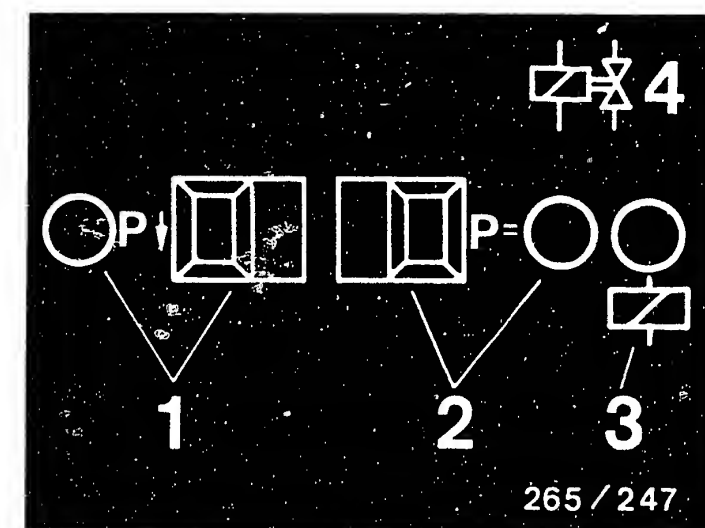
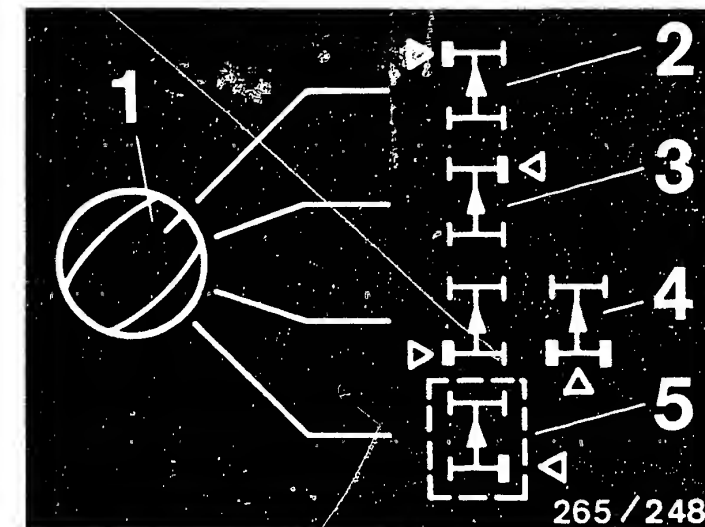
1. LED P (lower illustration) does not light up:

- \* Battery insufficiently charged.
- \* Repeat test with engine running.
- \* Valve relay (make contact) defective.
- \* Ground terminals must be bare and firmly connected.

Check the following leads for voltage drop and short circuit.

- \* Ground cable from K1/term. 10 via over-voltage protection relay term. 31b and term. 31 to ground.
- \* Lead from controller plug K1/term. 34 to ground.
- \* Positive lead from plug K1/term. 1 to over-voltage protection relay term. 30a.

Lead from valve relay term. 87 to B+.



Continued on next coordinate

Continued on next coordinate

TEST STEP 5 (CONTINUED) (TEST SPECIFICATIONS AND OPERATING INSTRUCTIONS)

2. Constantly press brake pedal.

Test specification:  
Wheel turnable by hand.

3. Release push-button P=.  
(upper illustration)

Test specification:  
LED P= goes out,  
wheel locks.

Pressure reduction:

4. Press push-button P arrow  
(upper illustration)

Test specification:  
LED P arrow lights up.  
Wheel turnable by hand.

5. Release push-button P arrow  
(upper illustration)

Test specification:  
LED P arrow goes out,  
wheel locks.

6. Release brake pedal.

Continued on next coordinate

2. Wheel locks or wheel can not  
be turned:

- \* Hydraulic brake lines at hydraulic modulator (lower illustration) mixed up.
- \* Solenoid-operated valves correctly electrically connected?

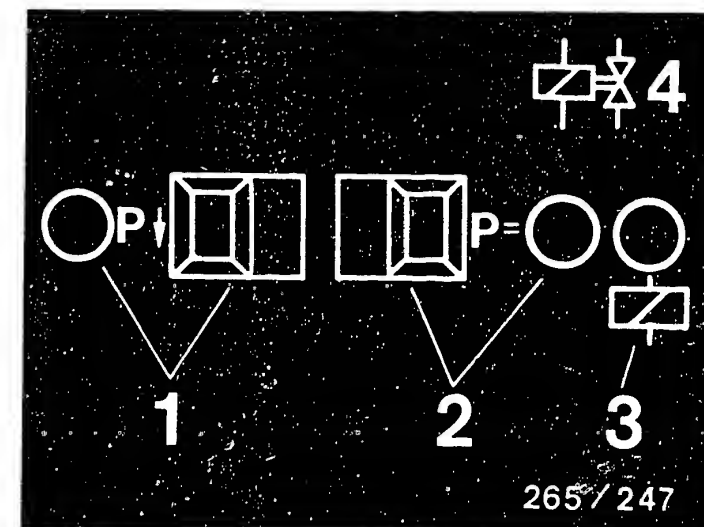
Wheel, front left:  
from plug K1/term. 2 to K3/  
term. 3.

Wheel, front right:  
from plug K1/term. 35 to K3/  
term. 1.

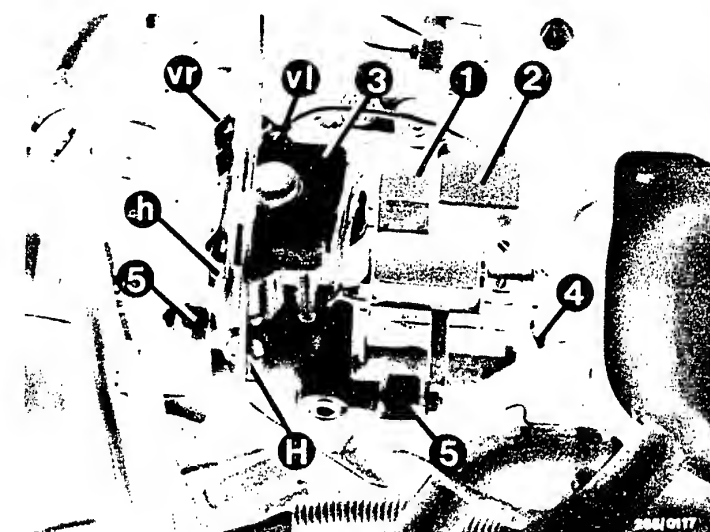
Rear axle:  
from plug K1/term. 18 to K3/  
term. 5.

- \* Check for firm seating of ground strap of pump.  
Clamping points must be bare.
- \* Check positive connection of pump  
for voltage drop and firm seating.  
Connection must be bare and firmly  
connected.
- \* Hydraulic modulator defective.

Continued on next coordinate



- 1 = Valve relay
- 2 = Motor relay
- 3 = Hydraulic modulator
- 4 = Ground term., pump motor
- 5 = Fastening screws



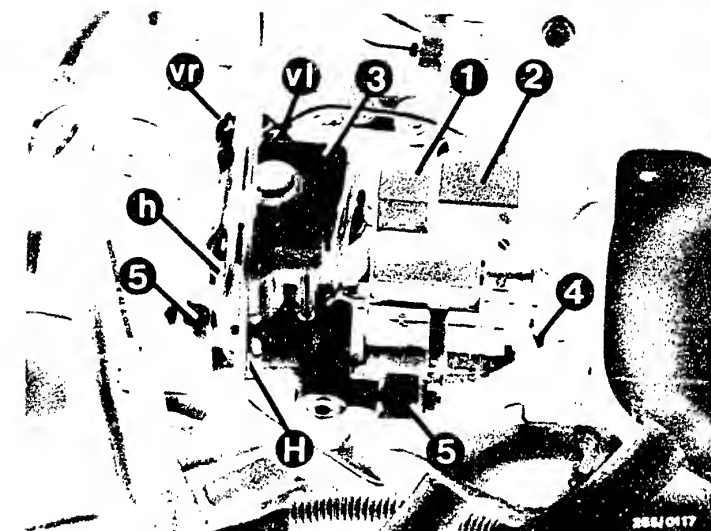
Removing the hydraulic modulator

- \* For reasons of safety, the hydraulic modulator must not be repaired, but replaced only as a complete unit.

Excepted are the motor and valve relays.  
Both relays may be replaced.

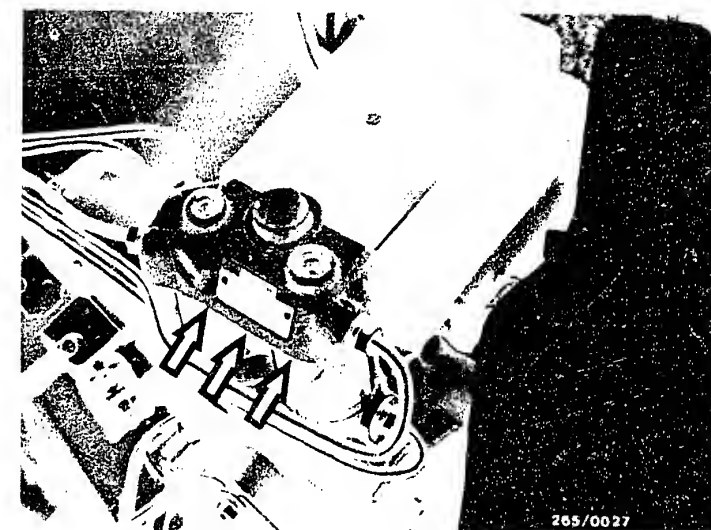
- \* Excepting brake-line connections, no screws on the hydraulic modulator may be loosened.  
In particular, the hexagon-socket-head cap screws or Torx screws must under no circumstances be loosened.  
After loosening, the brake circuits can never be sealed again.  
D a n g e r t o l i f e !

- \* Make visual examination for leaks in hydraulic modulator and brake-line connections.  
Pay particular attention to the sealing points indicated by arrows (upper illustration).  
If brake fluid is escaping, tighten (12...16 Nm) or replace the brake-line connections, or replace the hydraulic modulator.



- 1 = Valve relay
- 2 = Motor relay
- 3 = Hydraulic modulator
- 4 = Ground term., pump motor
- 5 = Fastening screws

Arrows = Sealing points



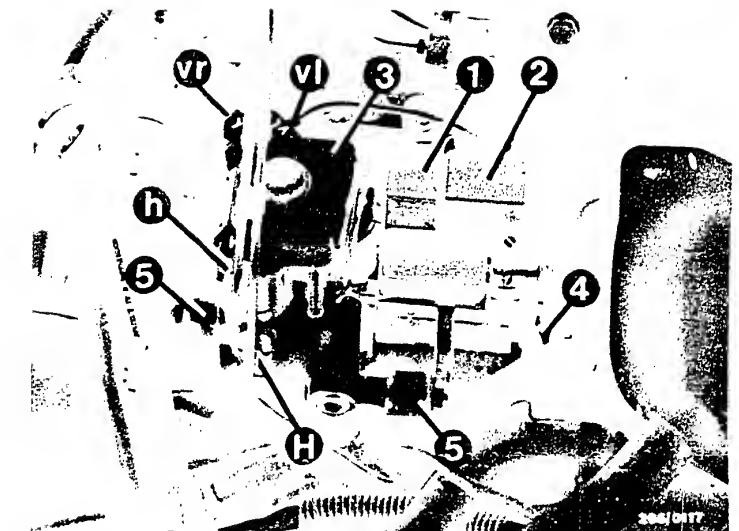
At the base of the hydraulic modulator there is a ventilation hole to the pump plunger. It is possible that small amounts of brake fluid escape at this point.

A complaint is only justified if a pool of brake fluid forms beneath the hydraulic modulator when the brake pedal is pressed several times.

\* When removing and installing the brake lines ensure that the lines are marked in accordance with the marking on the hydraulic modulator and are reconnected in the correct order (e.g. "1" from the hydraulic modulator must be connected to the front-left wheel-brake cylinder).

\* Marking on hydraulic modulator:

- l = Connection for front-left brake line (wheel-brake cylinder)
- r = Connection for front-right brake line (wheel-brake cylinder)
- h = Connection for brake line for rear axle
- V = Front-axle brake circuit from master brake cylinder
- H = Rear-axle brake circuit from master brake cylinder



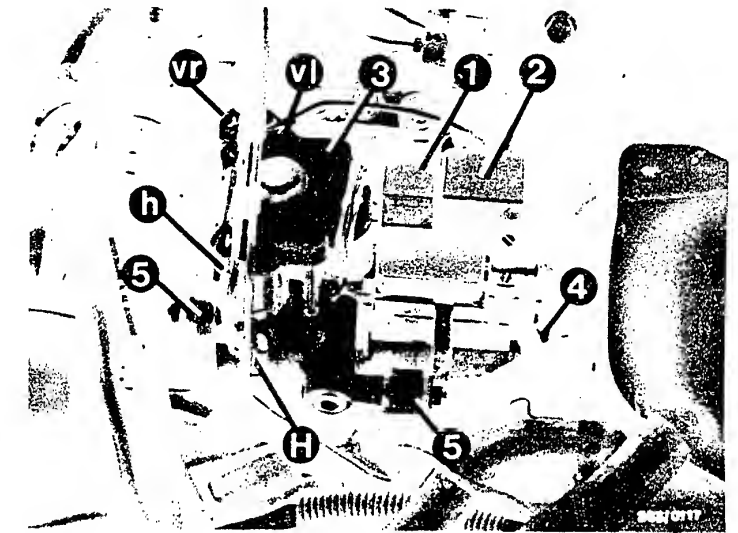
- 1 = Valve relay
- 2 = Motor relay
- 3 = Hydraulic modulator
- 4 = Ground term., pump motor
- 5 = Fastening screws



- \* Use only the specified double-head box wrench 9 x 11 mm for loosening and tightening the brake lines.
- \* Code brake lines and loosen from hydraulic modulator.
- \* Catch brake fluid and avoid contact with skin, clothing or paintwork!
- \* Seal brake lines and connections immediately with dummy plugs.
- \* Disconnect ground cable at pump motor.
- \* Loosen fastening screw and remove cap.
- \* Loosen hoop and remove plug.
- \* Loosen hexagon nuts of bracket and remove hydraulic modulator.

#### Installation

- \* Position hydraulic modulator into bracket and tighten with the hexagon nuts.
- \* Connect ground cable to pump motor. Connect 12-pin plug and fasten with the hoop.
- \* Tighten cap with screw on the hydraulic modulator.
- \* Connect brake lines to hydraulic modulator according to coding.
- \* Pay attention to tightening torque for brake-line connections at hydraulic modulator: 12...16 Nm.
- \* Bleed brake system and check for leaks.
- \* Thoroughly check ABS with tester.



- 1 = Valve relay
- 2 = Motor relay
- 3 = Hydraulic modulator
- 4 = Ground term., pump motor
- 5 = Fastening screws

## Component/Operation:

Checking the wheel-speed sensors for operation and mix-up.

## Note:

Check each wheel separately in turn. The rear axle can be checked at either the left or right wheel.

\* Operation:                      Position:  
Program switch                      | 6 |

\* Operation in vehicle and tester:

Chock up vehicle.

Ignition on.

The wheel to be tested must be freely turnable by hand. When testing the driven axle, the wheel not being tested must be locked.

Set the switch for wheel selection to the wheel to be tested (upper illustration).

Turn the wheel by hand until LED 2 above the instrument lights up without flickering. (Speed approx. 1 revolution per second).

Trouble-shooting:

1. LED (lower illustration) does not light up.

\* Wheel speed too low or too high.

\* Drive speed of the wheel too low or too high.

\* Ring gear with incorrect number of teeth or ring gear missing or loose.

\* Number of teeth:

Front axle: 48 teeth

Rear axle:

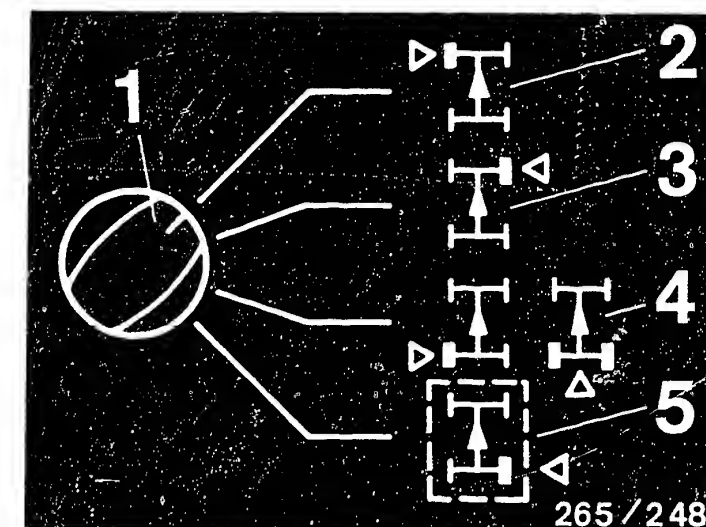
Differing number of teeth on propshaft depending upon transmission ratio.

2. LEDs light up and instrument indicates in incorrect switch position:

\* Plug connections of wheel-speed sensors mixed up.

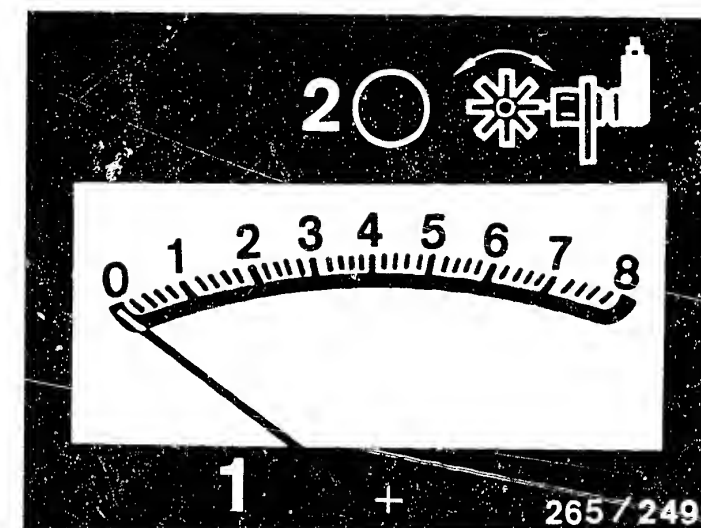
\* Leads at plug K1 incorrectly connected.

\* Check terminal assignment in accordance with terminal diagram.



- 1 = Wheel selector switch  
2 = Wheel, front left  
3 = Wheel, front right  
4 = Wheel, rear left  
or rear axle  
5 = Wheel, rear right

- 1 = Instrument  
2 = LED for wheel speed



Continued on next coordinate

Continued on next coordinate

Then read off reading at instrument.

Test specification (reading).

- \* Smallest reading = larger 1,6 divisions.
- \* Permissible fluctuation max. 25 % of greatest reading.

Take for a road test for final check.

Warning lamp must go out with engine running.

Drive at at least 30 km/h. Warning lamp must not light up again.

If no fault can be found with the LED tester, check for loose contacts or rubbed locations in the leads, or exchange controller.

Ignition off.

3. No instrument indication:

- \* Check wheel-speed sensors for short circuit. Disconnect plug connection and measure the winding resistance using ohmmeter:

Test specification: 0.6 ... 1.6 k  $\Omega$

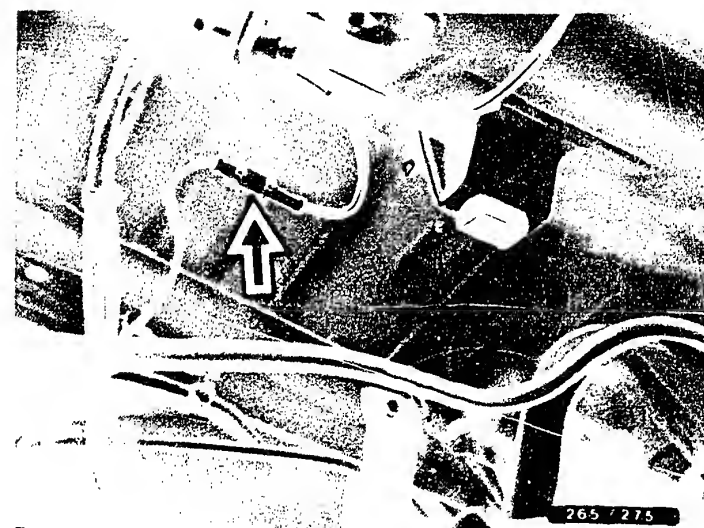
Check the following wheel-speed sensor leads for short circuit.

- \* Wheel, front left:  
From controller plug K1/term. 6 and term. 4 to plug connection K11.
- \* Wheel, front right:  
From controller plug K1/term. 11 and term. 21 to plug connection K13.
- \* Rear axle:  
From controller plug K1/term. 7 and term. 9 to plug connection K15.

Continued on next coordinate



Arrow = Wheel-speed-sensor plug connection, front right



Arrow = Wheel-speed-sensor plug connection, rear

4. Indication smaller than or approx. 1.0:

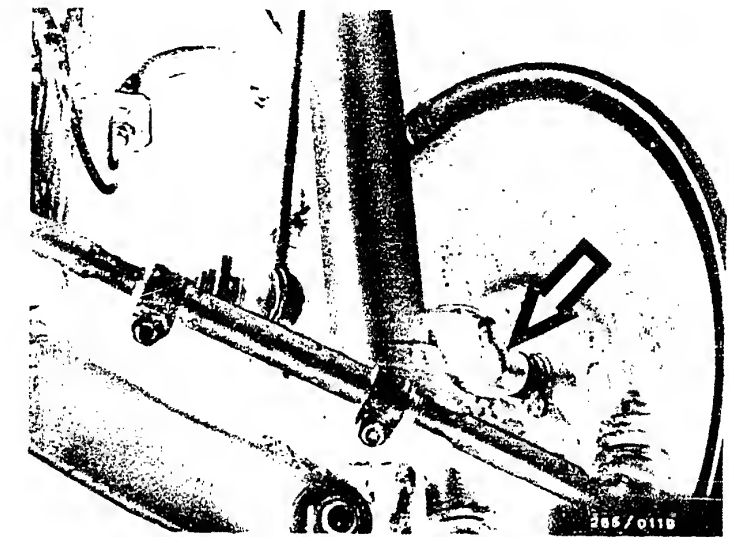
- \* Air gap between wheel-speed sensor and ring gear too wide.
- \* Nominal dimension 0.8 mm.
- \* Ring gear defective or loose or with incorrect number of teeth.
- \* Front axle: 96 teeth

Rear axle:  
Different number of teeth on Cardan shaft depending upon transmission ratio.

- \* Wheel-speed sensor defective: exchange.

5. Fluctuation too great:

- \* Wheel-bearing clearance too great.
- \* Ring gear defective.
- \* Ring gear out of round.



Arrow = Wheel-speed sensor front axle

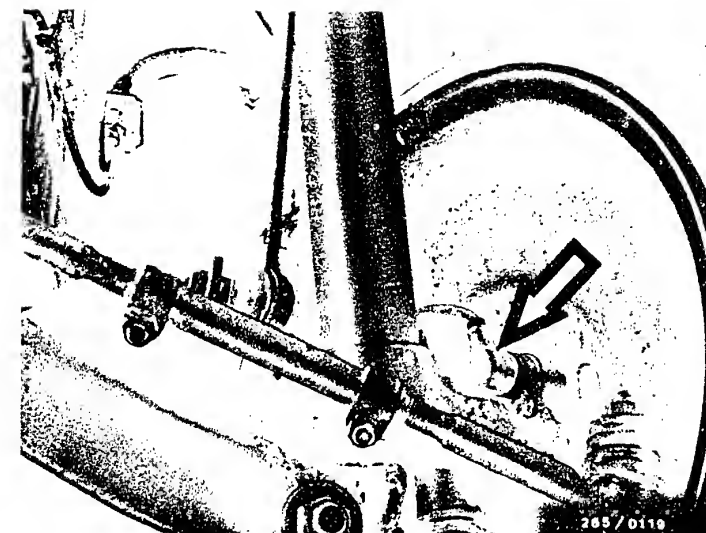
Arrow = Wheel-speed sensor rear axle



Continued on next coordinate

# Removing wheel-speed sensor:

- \* The plug connections for the front axle are at the respective frame side member and for the rear axle at the vehicle chassis.
- \* Remove plug connection from bracket and disconnect.
- \* Loosen fastening screw for wheel-speed sensor and carefully remove wheel-speed sensor.  
Do not use force!



Arrow = Wheel-speed sensor  
front axle

# Installing wheel-speed sensor:

- \* Check O-ring for cracks and if necessary replace.
- \* To mount, firstly remove the new wheel-speed sensor from the protective sleeve.
- \* Lightly grease wheel-speed-sensor housing with the lubricant, Molykote Longterm 2.
- \* Make sure that there are no metallic foreign bodies at the permanent-magnet edge.
- \* Push the wheel-speed sensor carefully into the locating bore as far as it will go.  
Do not drive in!
- \* Use new microencapsulated fastening screws. Tighten fastening screws to at least 8 Nm.
- \* Re-fasten lead at the specified points.
- \* Connect wheel-speed sensor to ABS wiring harness and clip plug connection into bracket.
- \* After repairing, test using LED tester.

Arrow = Wheel-speed sensor  
rear axle



## REPAIR PROHIBITION / MAXIMUM ALLOWABLE STORAGE TIME FOR ABS HYDRAULIC MODULATORS

13....39  
VDT-I-265/102 En  
1.1986

Replaces edition of 7.1984

### 1. Repair prohibition

ABS for passenger vehicles is a safety system.

Unauthorized tampering with ABS components brings with it the danger of impairment of the proper functioning of the ABS system.

- # For reasons of safety, therefore, the
- # hydraulic modulator may under no circum-
- # stances be repaired, but instead must be
- # exchanged as a complete unit.

Only the engine and valve relays may be exchanged.

No other screws or plugs may be loosened or removed.

### 2. Maximum allowable storage time

The maximum allowable storage time for hydraulic modulators is 5 years from the date of manufacture (FD) specified on the product.

This requires that the following storage conditions be fulfilled:

- Hydraulic modulator filled with brake fluid (supplied in filled condition).
- Vertical/upright position (hood on top).
- Ambient temperature between -20°C and +50°C.
- Dry storage.

After 5 years storage time, all rubber and plastic parts must be replaced and the hydraulic modulator must be subjected to a functional test.

The replacement of rubber and plastic parts and the functional test can be carried out only at the place of manufacture. After testing, the hydraulic modulators are marked with 1 and a new date of manufacture (FD).

Service workshops in the Federal Republic of Germany should send the hydraulic modulators to:

Robert Bosch GmbH Abt. K1/VAK 2,  
Robert-Bosch-Straße, 7141 Schwieberdingen.

Service workshops in other countries are requested to send the hydraulic modulators to:

Robert Bosch GmbH, KH/LAV 2 - Auspackraum,  
z.W. an K1/VAK 2, Auf der Breit 4,  
D-7500 Karlsruhe 41  
West Germany.

The hydraulic modulators should be sent to us pre-paid. Please refer to this Technical Bulletin on the enclosed delivery ticket.

A fee is charged for parts replacement and functional testing.

Responsible:

ROBERT BOSCH GMBH

Division KH

Technical After-Sales Service (KH/VKD 2)

Please address questions and comments concerning the contents to our authorized representative in your country.

## TABLE OF CONTENTS

Section	Coordinates
Structure of microcard.....	A01
Special features.....	A02
Test specifications.....	A03-A04
Rapid diagnosis chart with ABS2 LED tester.....	A05-A16
Electrical terminal diagram.....	A17-A18
Test equipment and tools.....	A19-A20
Installation position of components.....	A21-A24
Leakage check.....	A25
General information.....	A26-A28
Trouble-shooting:	
Check ABS warning lamp.....	B01-B03
Operation of the ABS2 LED tester.....	B04-B06
Test requirements.....	B07-B11
Test chart with ABS2 LED tester.....	C01-D22
Technical Bulletins.....	N01-N02

For production reasons:  
continued on the following  
coordinate.

## IMPRESSUM

(c) 1986 Robert Bosch GmbH  
Automotive Equipment - After-Sales Service  
Department for Technical Publications KH/VDT  
Postfach 50, D-7000 Stuttgart 1.  
Published by: After-Sales Service  
Department for Training and Technology  
(KH/VSK). Press date: 07.86.  
Please direct questions and comments  
concerning the contents to our authorized  
representative in your country.  
This publication is intended only for the  
BOSCH After-Sales Service Organization, and  
may not be passed on to third parties  
without our consent.  
Microfilmed in the Federal Republic of Ger-  
many. Microphotographié en République Fédé-  
rale d'Allemagne.